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A PRELIMINARY LIST OF THE HEPATICAE OF PUERTO RICO INCLUDING VIEQUES AND MONA ISLAND*

F. M. PAGÁN

The island of Puerto Rico has been systematically explored for hepatics by a number of collectors. From 1847 to 1850 Carl Schwanecke made several collections comprising 59 species, a report on which was later published by Hampe and Gottsche in Linnaea.[1] Between the years 1885 and 1887 P. Sintenis added considerably to this total, and by 1888 the number of species known to occur in the Island had been increased to 111, as recorded by Stephani.[2] Since 1899 several other collections have been made, important among which are those by Mr. and Mrs. A. A. Heller, 1899 and 1900, by Dr. A. W. Evans, 1900 and again in 1902, by Professor L. M. Underwood and R. F. Griggs, 1901, by Dr. N. L. Britton and Mrs. Britton, as well as by several other collectors, principally from the staff of the New York Botanical Garden. During the late part of 1936 and in the spring and summer of 1937 the writer made a number of collections throughout the Island. These he studied at the Osborn Botanical Laboratory of Yale University from October, 1937, to July, 1938.

In the organization of the material the writer has followed, to a certain extent, the views on the classification of the hepaticae as outlined by Buch, Evans, and Verdoorn in a recent paper.[3]

* Contribution from the Department of Biology of the University of Puerto Rico and the Osborn Botanical Laboratory of Yale University.

[1] Linnaea 25: 333–357. 1852.

[2] Hedwigia 27: 276–302. 1888.

[3] Annales Bryologici 10: 3–8. 1937.

The following report, containing 244 species, is based largely upon the publications of previous workers, especially those of Professor A. W. Evans, who has contributed more than any other person to our present knowledge of the hepatic flora of Puerto Rico. It contains in addition several species not previously reported from the Island.

The locations of the specimens seen by the writer are indicated by the following abbreviations: Y., herbarium of Yale University; N., herbarium of the New York Botanical Garden; F., Farlow Herbarium of Harvard University; P., private herbarium of the writer at the University of Puerto Rico.

In the preparation of this paper the writer is especially indebted to Professor A. W. Evans for his valuable suggestions and for the privilege of using his private library, to Professor H. Castle for helpful suggestions and for the determination of the species of *Radula*, to Dr. Margaret Fulford of the University of Cincinnati for checking over his determinations of the species of *Bazzania* and for the identification of other species of the same genus, to Mrs. L. W. Riddle for the loan of specimens from the Farlow Herbarium, and to Miss Rosalie Weikert for allowing him access to the Herbarium of the New York Botanical Garden. He also wishes to express his gratitude to all those who in one way or another have made this work possible.

RICCIACEAE

RICCIA ELLIOTTII Steph., Bull. Herb. Boiss. **6**: 324. 1898. On wet, sunny soil. Between Sardinera and Ubero, Mona Island, 1914, *N. L. Britton, J. F. Cowell & W. E. Hess 1749a* (N.); vicinity of Coamo Springs, on top of hill on river flat, 1922, *N. L. Britton, E. G. Britton & M. S. Brown 5979* (N., Y.).

DISTRIBUTION: Dominica; St. Thomas.

RICCIA MEMBRANACEA Gottsche & Lindenb., G. L. N. Syn. Hep. 608. 1846. On wet banks. Vicinity of Cayey, 1900, *Evans 65* (N., Y.).

DISTRIBUTION: Brazil, Mexico, North America.

RICCIA VIOLACEA Howe, Ann. Mo. Bot. Gard. **2**: 51. 1915. On wet, sunny soil. Between Sardinera and Ubero, Mona Island, 1914, *N. L. Britton, Cowell & Hess 1749b* (N.).

DISTRIBUTION: Northern Mexico, Cuba and the Bahama Islands.

OPERCULATAE

ASTERELLA ELEGANS (Spreng.) Trevis., Rend. Ist. Lomb. II. **7**: 785. 1874. On wet shaded rocks. El Yunque, 1902, *Evans 87* (Y.);

Sierra de Naguabo, Río Prieto and adjacent hills, 1914, *Shafer 3695* (Y., N.).

DISTRIBUTION: Cuba, Santo Domingo, Jamaica.

MARCHANTIACEAE

DUMORTIERA HIRSUTA (Sw.) Nees, Nova Acta Acad.-Carol. **12**: 410. 1824. On wet rocks and on the soil. Luquillo Mts., 1899, *Heller 770* (Y.); El Yunque, 1900, *Evans 6,161* (Y.); vicinity of Cayey, 1900 *Evans 77* (Y.); vicinity of Mayagüez, 1906, *E. G. Britton & D. W. Marble 525* (Y.); between Ponce and Utuado, 1906, *Britton & Marble 785* (Y.); Luquillo Mts., 1912, *Bro. Hioram 424* (Y.); Bo. de Maizales, Sierra de Naguabo, 1914, *N. L. Britton & Cowell 3108* (Y.); Bo. Guaraguao, Ponce, 1937, *Pagán 71* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 84, 126* (P.); El Yunque, 1937, *Pagán 156, 184, 197* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 333* (P.). Originally collected by *Schwanecke; Sintenis 31, 57, 89, 105, 121.*

DISTRIBUTION: Widely distributed in tropical regions; also found in western and southern Europe, and in the eastern United States.

DUMORTIERA NEPALENSIS (Tayl.) Nees, Naturg. Eur. Leberm. **4**: 169. 1838. On moist rocks. Adjuntas to Ponce Road, 1906, *Howe 1256* (Y., N.).

DISTRIBUTION: Southern United States, West Indies, South America, southeastern Asia, Federated Malay States, Japan.

MARCHANTIA CHENOPODA L., Sp. Pl. 1137. 1753. On rocks and on the soil. Vicinity of Adjuntas, 1886, *Sintenis 51* (Y.); vicinity of Cayey, 1900, *Evans 95* (Y.); without definite locality, 1901, *Underwood & Griggs 732* (Y.); Mt. Morales, Utuado, 1906, *Howe 1098* (Y., N.); between Ponce and Utuado, 1906, *Britton & Marble 778* (Y., N.); La Juanita, near Las Marías, 1915, *E. G. Britton 3964* (Y., N.); between Ponce and Adjuntas, 1915, *E. G. Britton 5367* (Y., N.); vicinity of Utuado, 1915, *E. G. Britton 4091* (Y., N.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 302* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 394* (P.).

DISTRIBUTION: A widely distributed species in tropical America.

MARCHANTIA DOMINGENSIS Lehm. & Lindenb., Lehmann, Stirp. Pug. **6**: 22. 1834. On rocks. Vicinity of Cayey, 1900, *Evans 82* (Y.); Lares, 1901, *Underwood & Griggs 36* (Y.); Utuado, 1901, *Underwood & Griggs 836* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 594* (Y.); Lares, 1914, *Johnston 2070* (Y.); vicinity of Utuado, 1915, *E. G. Britton 5212* (Y.); Coamo Springs, 1922, *N. L. Britton, E. G. Britton & M. S. Brown B* (Y.).

DISTRIBUTION: A widely distributed species in the southern United States, the West Indies, Central America, and Venezuela.

METZGERIACEAE

METZGERIA DICHOTOMA (Sw.) Nees, G.L.N. Syn. Hep. 504. 1846.

On trees. Mt. Morales, Utuado, 1906, *Britton & Marble 498* (Y.); Mte. Torrecilla, 1915, *N. L. Britton & Cowell 5674a* (Y.); vicinity of Villalba, 1922, *N. L. Britton, E. G. Britton & M. S. Brown 6411* (Y.).

DISTRIBUTION: Mexico, Brazil, Cuba, Jamaica.

METZGERIA FURCATA (L.) Dumort., Recueil d'Obs. sur les Jung. 26. 1835. On trees and on rocks, mountain between Guayama and Cayey, 1922, *N. L. Britton, E. G. Britton & M. S. Brown 6597* (Y.).

DISTRIBUTION: Europe, Africa, Australia, New Zealand, eastern United States, West Indies.

METZGERIA HAMATA Lindb., Acta Soc. F. et Fl. Fenn. **12**: 25. *f. 25.* 1877. On trees and logs. El Yunque, 1900, *Evans 46* (Y.); El Yunque, 1902, *Evans 80, 96. 163* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7720* (Y.); El Yunque, 1937, *Pagán 154* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 377 p.p., 380* (P.); El Yunque, 1937, *Pagán 526* (P.).

DISTRIBUTION: South America, West Indies, New Zealand, Ireland, western Great Britain, Faroe Islands, Himalayas, Japan, Java, Sumatra, Alaska, Allegheny Mountains.

METZGERIA OLIGOTRICHA Evans, Ann. Bot. **24**: 281. *f. 7.* 1910. On trunks of trees. Mt. Morales, Utuado, 1906, *Howe 1118* (Y., N.); near Río Piedras, 1911, *Bro. Hioram 4* (Y.); Arroyo de los Corchos between Adjuntas and Jayuya, 1915, *E. G. Britton 5354* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 261* (P.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 313, 318* (P.).

DISTRIBUTION: Cuba, Jamaica.

METZGERIA UNCIGERA Evans, Ann. Bot. **24**: 276. *f. 3.* 1910. On bark of living trees. Mt. Morales, Utuado, 1906, *Howe 1128* (Y.); El Yunque, 1937, *Pagán 171* (P.); near Maricao, 1937, *R. H. Moore 11* (P.).

DISTRIBUTION: Florida.

METZGERIA VIVIPARA Evans, Ann. Bot. **24**: 287. *f. 11.* 1910. On trunk of trees. Barceloneta, 1887, *Sintenis 144* (Y.), distributed as *M. furcata;* between Utuado and Adjuntas, 1906, *Britton & Cowell 1242* (Y.); Lares, 1911, *A. Morgues 2* (Y.); Mte. Torrecilla, 1911, *Bro. Hioram 6* (Y.); Barranquitas, 1911, *Bro. Hioram 5* (Y.); Río de Maricao, 1913, *E. G. Britton 2499, 2532* (Y.); Indiera Baja north of Yauco, 1923, *Britton & Britton 7242* (Y.); Bo. Guaraguao, Ponce, 1936, *Pagán 15* (P.).

DISTRIBUTION: Known only from Puerto Rico.

DILAENACEAE

PALLAVICINIA LYELLII (Hook.) S. F. Gray, Nat. Arr. Brit. Pl. **1**: 775. 1821. On moist shaded banks, on rotten wood and on the bark of living trees. Sierra de las Piedras, 1886, *Sintenis 115* (Y.); north

side of the Luquillo Mts., 1899, *Heller 1153, 1154* (Y.); east slope of the Luquillo Mts., 1900, *Heller 4639a, 4647* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 740* (Y.); El Yunque, 1912, *Johnston 4674* (Y.); Sierra de Naguabo, 1914, *Shafer 3702* (Y.); Mt. El Duque, Sierra de Naguabo, 1914, *Shafer 3069* (Y.); Sierra de Naguabo, 1914, *N. L. Britton, J. F. Cowell & S. Brown 5677* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5467, 5468* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 263* (P.); El Yunque, 1936, *Pagán 204* (P.).

DISTRIBUTION: Widely distributed, especially in tropical regions.

SYMPHYOGYNA ASPERA Steph., McCormick, Bot. Gaz. **58**: 401. *pl. 30–32.* 1914. On shaded ground and on logs. El Yunque, 1900, *Evans 58* (Y.); El Yunque, 1902, *Evans 189* (Y.); Mt. Morales, Utuado, 1906, *Howe 1119, 1137* (Y., N.); Barranquitas, 1911, *Bro. Hioram 7* (Y., N.); Arroyo de los Corchos between Adjuntas and Jayuya, 1915, *E. G. Britton 5343b* (Y., N).; mountain between Guayama and Cayey, 1922, *Britton, Britton & M. S. Brown 6595, 6596* (Y.); vicinity of Ala de la Piedra, above Villalba, 1922, *E. G. Britton & M. S. Brown 6128, 6413* (Y., N).; Maricao, 1937, *Pagán 209* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 406, 413* (P.); El Yunque, 1937, *Pagán 605a* (P.).

DISTRIBUTION: Mexico, Brazil, Colombia, Ecuador, Paraguay, Bolivia, Cuba, Martinique, St. Vincent.

SYMPHYOGYNA BRONGNIARTII Mont., Ann. Sci. Nat. Bot. II. **19**: 265. *pl. 9, f. 1.* 1843. On moist banks, on rocks and on logs. Mt. Morales, Utuado, 1906, *Howe 1103* (Y., N.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2182* (Y., N.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5483* (Y.); El Yunque, 1937, *Pagán 178, 195, 527* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 288* (P.).

DISTRIBUTION: Brazil, Colombia, Ecuador, Bolivia, Guatemala, Costa Rica, Venezuela, Grenada, Cuba, Guadeloupe, Dominica, Martinique, St. Lucia.

SYMPHYOGYNA TRIVITTATA Spruce, Jour. Linn. Soc. Bot. **30**: 365. *pl. 30, f. 7–11.* 1894. On soil and on logs. Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5484* (Y., N.); mountain between Guayama and Cayey, 1922, *Britton, Britton & S. Brown 6612* (Y., N.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 310* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 454* (P.).

DISTRIBUTION: Cuba, Guadeloupe, Martinique.

MONOCLEACEAE

MONOCLEA GOTTSCHEI Lindb., Rev. Bryol. **13**: 102. 1886. On moist rocks. Adjuntas, 1886, *Sintenis 81* (Y.); El Yunque, 1900, *Evans 33* (Y.); El Yunque, 1902, *Evans 98* (Y.); vicinity of Utuado,

1906, *Britton & Cowell 1045* (Y.); Mt. Morales, Utuado, 1906, *Howe 1141* (Y., N.); Doña Juana Waterfall, Toro Negro, 1922, *Britton, Britton & M. S. Brown 6207, 6208* (Y.); valley of Toro Negro, north of Villalba, 1923, *Britton, Britton & F. W. Horne 7477* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 105* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 271, 289, 296* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 344, 349* (P.).

DISTRIBUTION: Costa Rica, Guatemala, Venezuela, Bolivia, Colombia, Peru, Chile, Jamaica, Guadeloupe, Japan.

ANEURACEAE

RICCARDIA **bogotensis** (Gottsche) comb. nov. *Pseudoneura bogotensis* Gottsche, Ann. Sci. V. **1**: 184. 1864. On a rotten log. Mte. Cerrote, near Adjuntas, 1937, *Pagán 112* (P.).

DISTRIBUTION: Brazil, Colombia, Cuba, Santo Domingo, Guadeloupe.

RICCARDIA **digitiloba** (Spruce) comb. nov. *Aneura digitiloba* Spr. Bull. Soc. Bot. France **26** (Congr. Bot.): CCI. 1889. Without definite date, number or locality, *Schwanecke*, as *Aneura palmata* var. *arenaria* Nees.

DISTRIBUTION: Brazil, Dominica, Guadeloupe.

RICCARDIA FUCOIDES (Sw.) Schiffn., Conspect. Hep. Arch. Indici 54. 1898. On the roots of palms. Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2079* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7719* (Y.); vicinity of Villalba, 1936, *Pagán 13* (P.); El Yunque, 1937, *Pagán 553* (P.). First collected by *Schwanecke* under the name of *Metzgeria fucoides* M. & N.; without definite locality, *Sintenis 138*.

DISTRIBUTION: Brazil, Costa Rica, Argentine, Grenada, Jamaica, Dominica, Martinique, Guadeloupe.

RICCARDIA LATIFRONS Lindb., Not. Soc. F. et Fl. Fennica **13**: 372. 1874. On roots of palms and on rotten logs. Mte. Cerrote, near Adjuntas, 1937, *Pagán 118a* (P.).

DISTRIBUTION: Widely distributed in Europe, Asia and North America; also reported from Bermuda.

RICCARDIA MULTIFIDA (L.) S. F. Gray, Nat. Arr. Brit. Pl. **1**: 683. 1821. On moist soil, wet rocks and rotten logs. Mte. Cerrote, near Adjuntas, 1937, *Pagán 74a, 89, 111, 114, 116, 119* (P.); El Yunque, 1937, *Pagán 168* (P.).

DISTRIBUTION: Widely distributed in Europe, Asia and North America.

RICCARDIA PINGUIS (L.) S. F. Gray, Nat. Arr. Brit. Pl. **1**: 683. 1821. On rotten palm leaves. Luquillo Mts., 1899, *Heller 1134* (Y.); El Yunque, 1902, *Evans 68, 168* (Y.); between Adjuntas and Jayuya,

1915, *E. G. Britton 5345* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 109* (P.); El Yunque, 1937, *Pagán 190* (P.).

DISTRIBUTION: Europe, Asia, North and South America.

RICCARDIA **portoricensis** (Steph.) comb. nov. *Aneura portoricensis* Steph., Bull. Herb. Boiss. **7**: 739 (Spec. Hep. **1**: 249) 1899. Without definite date or locality, *Schwanecke 55* (F.).

DISTRIBUTION: Known only from Puerto Rico.

RICCARDIA **Schwaneckei** (Steph.) comb. nov. *Aneura Schwaneckei* Steph., Hedwigia **27**: 278. 1888. On rotten logs. El Yunque, 1937, *Pagán 157, 159, 198, 484, 497, 556* (P.); without definite date or locality, *Schwanecke 55* (F.).

DISTRIBUTION: Brazil, St. Vincent, Dominica.

RICCARDIA **virgata** (Gottsche) comb. nov. *Aneura virgata* Gottsche, in Steph. Hedwigia **27**: 277. 1888. On trees and on rocks. Mte. Torito, Canóvanas, 1937, *Pagán 320a* (P.).

DISTRIBUTION: Jamaica, Guadeloupe, Martinique.

CODONIACEAE

FOSSOMBRONIA BRASILIENSIS Steph., Mém. Herb. Boiss. **16**: 28 (Spec. Hep. **1**: 382). 1900. On rocks and on clay banks. Vicinity of Cayey, 1900, *Evans 83* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 6142* (Y.); Mte. Mesas, Mayagüez, 1915, *N. L. Britton & S. Brown 3883* (Y.); La Juanita, near Las Marías, 1915, *E. G. Britton 3966, 3967 3968* (Y.); vicinity of Maricao, 1915, *E. G. Britton 4103, 4299* (Y.); between Cabo Rojo and San Germán, 1915, *N. L. Britton, Cowell & S. Brown 4317* (Y.); Doña Juana Waterfall, Toro Negro, 1922, *Britton, Britton & M. S. Brown 6210* (Y.); vicinity of Barranquitas, 1922, *same collectors 6626* (Y.); mountain between Guayama and Cayey, 1922, *same collectors 6594* (Y.); vicinity of Villalba, 1937, *Pagán 146* (P.); vicinity of Cayey, 1937, *Pagán 163* (P.).

DISTRIBUTION: Southern New England to Brazil, Texas, Cuba, Trinidad.

HARPANTHACEAE

HETEROSCYPHUS **Elliottii** (Steph.) comb. nov. *Chiloscyphus Elliottii* Steph., Bull. Herb. Boiss. **8**: 55 (Spec. Hep. **3**: 231) 1908. On tree trunk, at base. Mte. Torito, Canóvanas, 1937, *Pagán 397* (P.).

DISTRIBUTION: Dominica.

LOPHOCOLEA CONNATA (Sw.) Nees, G.L.N. Syn. Hep. 153. 1845. Without definite date or locality, *Sintenis 159*.

DISTRIBUTION: Jamaica.

LOPHOCOLEA CUBANA Steph., Bull. Herb. Boiss. **6**: 963 (Spec. Hep. **3**: 143). 1906. On rotten logs. Vicinity of Aibonito, 1899, *Heller 908* (Y.); El Yunque, 1902, *Evans 38* (Y.); Río de Maricao, 1913, *E.*

G. Britton 2493 (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 74, 76* (P.).

DISTRIBUTION: Cuba.

LOPHOCOLEA MARTIANA Nees, G.L.N. Syn. Hep. 152. 1845. On rotten logs, old stumps, and at the base of living palms. North slope of the Luquillo Mts., 1899, *Heller 1152, 1156, 1157* (Y.); east slope of the Luquillo Mts., 1900, *Heller 4639, 4643* (Y.); El Yunque, 1900, *Evans 20, 86, 139, 172* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 608* (Y.); Mt. Morales, Utuado, 1906, *Howe 451* (Y., N.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2168* (Y.); Maricao to Mte. Alegrillo, 1913, *E. G. Britton 2654* (Y.); Mte. Torrecilla, 1913, *N. L. Britton, Cowell & S. Brown 4683* (Y.); Indiera Fría, near Maricao, *same collectors 4408, 4411, 4427* (Y.); Río de Maricao, 1915, *N. L. Britton & J. F. Cowell 4245* (Y.); La Juanita, near Las Marías, 1915, *E. G. Britton 4001* (Y.); vicinity of Ala de la Piedra, above Villalba, 1922, *N. L. Britton & F. S. Earle 6125* (Y.); Cerro de las Piñas, near Las Cruces, 1922, *N. L. Britton, J. Matz & C. E. Chardón 6909* (Y.); San Narciso, 1923, *Britton & Britton 7311* (Y.); Doña Juana Waterfall, near Villalba, 1936, *Pagán 56* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 101* (P.); El Yunque, 1937, *Pagán 153, 160, 164* (P.); Maricao, 1937, *Pagán 219* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 281* (P.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 305* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 345, 350* (P.).

DISTRIBUTION: Widely distributed in tropical America; also found in Florida.

LOPHOCOLEA SINTENISII Steph. Spec. Hep. **6**: 293. 1922. Without definite date, locality or number, *Sintenis*.

DISTRIBUTION: Known only from Puerto Rico.

EPIGONIANTHACEAE

APOTOMANTHUS SUCCULENTUS (Rich.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 91. 1893. On roadside banks. Vicinity of Utuado, 1915, *E. G. Britton 5211* (Y.).

DISTRIBUTION: Tropical America.

JAMESONIELLA COLORATA (Lehm.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 83. 1893. On rocks and on trees. Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7646* (Y.); El Yunque, 1937, *Pagán 150a* (P.).

DISTRIBUTION: Southern Africa, Chile, Patagonia, Australia, Tasmania, New Zealand, Peru, Bolivia, Ecuador, Venezuela, Guiana, Brazil, Costa Rica.

JUNGERMANNIA DOMINICENSIS Spruce, Jour. Linn. Soc. Bot. **30**: 363. *pl. 29, f. 1–3.* 1894. On banks. Indiera Baja, north of Yauco, 1923, *Britton & Britton 7239* (Y.).

DISTRIBUTION: Dominica, St. Vincent.

LOPHOZIA SCHISTOPHILA (Spruce) Steph., Bull. Herb. Boiss. **2**: 46 (Spec. Hep. **2**: 146) 1902. On banks. Along the Guayama-Cayey Road, 1922, *Britton, Britton & Earle 6467* (Y.).
DISTRIBUTION: Peru, Brazil, Dominica.

MYLIA **gibbosa** (Tayl.) comb. nov. *Chiloscyphus gibbosus* Tayl., Lond. Jour. Bot. **5**: 283. 1846. On twigs. Mt. El Duque, Sierra de Naguabo, 1914, *Shafer 3723* (Y.).
DISTRIBUTION: West Indies.

NARDIA CALLITHRIX (Lindenb. & Gottsche) Spruce, Trans. & Proc. Edinb. Bot. Soc. **15**: 520. 1885. Moist soil and rocks. Without definite date or locality, *Sintenis 56*.
DISTRIBUTION: Ecuador, Mexico, St. Vincent.

PLAGIOCHILACEAE

PLAGIOCHILA ABRUPTA Lehm. & Lindenb., Spec. Hep. 106. *pl. 20.* 1844. On tree trunks. El Yunque, 1937, *Pagán 174, 566a* (P.); originally collected by *Schwanecke* in the Luquillo Mts., *1847–1850, without number* (F.).
DISTRIBUTION: French Guiana, St. Vincent, Dominica.

PLAGIOCHILA ADIANTOIDES (Sw.) Dumort., Recueil d'Obs. sur les Jung. 15. 1835. On trees. Without definite date, locality or number, *Schwanecke* (F.).
DISTRIBUTION: Tropical America; common in the West Indies.

PLAGIOCHILA ARCUATA Lindenb., Spec. Hep. 91. *pl. 16.* 1844. Without definite date, locality or number, *Schwanecke.*
DISTRIBUTION: Cuba, St. Vincent.

PLAGIOCHILA BICORNIS Hampe & Gottsche, Linnaea **25**: 338. 1852. On rocks and on living trees. Mte. Torito, Canóvanas, 1937, *Pagán 412* (P.); El Yunque, 1937, *Pagán 468, 569* (P.); without definite locality, *Schwanecke, Sintenis 39.*
DISTRIBUTION: Dominica.

PLAGIOCHILA BIDENS Gottsche, Ann. Sci. Nat. 332. *pl. 10, f. 1–5.* 1857. On rocks and on living trees. Mte. Guilarte, Adjuntas, 1937, *Pagán 439, 450 p.p.* (P.); El Yunque, 1937, *Pagán 476, 530, 566* (P.).
DISTRIBUTION: Guadeloupe, Dominica.

PLAGIOCHILA BREUTELIANA Lindenb., Spec. Hep. 150. *pl. 32.* 1844. On trees and on logs. Sierra de Naguabo, 1886, *Sintenis 116* (Y.); El Yunque, 1900, *Evans, 25, 26* (Y.).
DISTRIBUTION: Mexico, Costa Rica, Colombia, St. Kitts, Guadeloupe, Dominica, St. Vincent.

PLAGIOCHILA BURSATA (Desv.) Lindenb., Spec. Hep. 88. *pl. 15.* 1844. On living trees. Sierra de Luquillo, 1885, *Sintenis 22* (Y.); El

Yunque, 1900, *Evans 37* (Y.); El Yunque, 1902, *Evans 58, 111* (Y.); El Yunque, 1912, *Bro. Hioram 400* (Y.); Sierra de Naguabo, 1914, *Shafer 3771* (Y.); Río Icaco and adjacent hills, Sierra de Naguabo, 1914, *Stevens & Hess 2822b* (Y.); Alto de la Bandera, near Adjuntas, 1915, *Shafer 3703* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7752* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 387* (P.); El Yunque, 1937, *Pagan 467, 517* (P.).

DISTRIBUTION: Widely distributed in tropical America.

PLAGIOCHILA CHINANTLANA Gottsche, Mex. Leverm. 12. *pl. 5, f. 1–7.* 1863. On soil. El Yunque, 1937, *Pagán 532* (P.); without definite date or locality, *Sintenis 8.*

DISTRIBUTION: Mexico, Colombia.

PLAGIOCHILA CONFUNDENS Lindenb. & Gottsche, Linnaea **25**: 337. 1852. On trees and on twigs. Without definite date or locality, *Sintenis 50, 70, 101, 103, 107* (F.).

DISTRIBUTION: French Guiana, Costa Rica, Venezuela, Cuba, St. Vincent, Dominica.

PLAGIOCHILA CONTIGUA Gottsche, Mex. Leverm. 30. *pl. 14, f. 1–6.* 1863. On trunk of tree. Bo. Cialitos, Jayuya, 1937, *Pagán 340a* (P.); without definite date or locality, *Sintenis 140.*

DISTRIBUTION: Mexico.

PLAGIOCHILA DICHOTOMA (Web.) Dumort., Recueil d'Obs. sur les Jung. 15. 1835. On rocks. Maricao, 1937, *Pagán 240* (P.).

DISTRIBUTION: Brazil, Jamaica, Trinidad.

PLAGIOCHILA DOMINICENSIS Tayl., Lond. Jour. Bot. **5**: 270. 1846. Without definite date or locality, *Sintenis 45.*

DISTRIBUTION: Dominica, Guadeloupe.

PLAGIOCHILA DUBIA Lindenb. & Gottsche, G.L.N. Syn. Hep. 630. 1847. On bark. Laguna San José, near Río Piedras, 1937, *Pagán 416* (P.); without definite date or locality, *Sintenis 140.*

DISTRIBUTION: Mexico, Venezuela, Cuba.

PLAGIOCHILA ERRONEA Steph., Bull. Herb. Boiss. **2**: 873 (Spec. Hep. **2**: 242). 1902. Without definite date, locality or number, *Sintenis.*

DISTRIBUTION: Brazil, Guadeloupe.

PLAGIOCHILA FLACCIDA Lindenb., Spec. Hep. 78. *pl. 16.* 1844. On rocks. Sierra de Luquillo, 1885, *Sintenis 24* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 298* (P.).

DISTRIBUTION: Brazil, Venezuela, St. Vincent, Guadeloupe.

PLAGIOCHILA HETEROMALLA Lehm. & Lindenb., G.L.N. Syn. Hep. 56. 1844. Without definite date, locality or number, *Schwanecke* (F.).

DISTRIBUTION: Chile, Colombia.

PLAGIOCHILA HUSNOTI Steph., Bull. Herb. Boiss. **5**: 178 (Spec. Hep.

2: 506). 1905. On trees and rocks. Without definite date, locality or number, *Sintenis*.

DISTRIBUTION: Guadeloupe, Dominica.

PLAGIOCHILA HYPNOIDES Lindenb., Spec. Hep. 37. *pl. 7 & 11*. 1844. On trees. La Juanita, near Las Marías, 1915, *E. G. Britton 3977* (Y.).

DISTRIBUTION: Common in tropical America.

PLAGIOCHILA LUDOVICIANA Sull., Musci Alleg. *n. 223*. 1845; Amer. Jour. Sci. and Arts II. 1: 73. *pl. 16, f. 4–12*. 1846. On bark and on wet rocks. Near Pueblito del Río, 1930, *Britton & Britton, without number* (Y.); Laguna San José, near Río Piedras, 1937, *Pagán 418* (P.); vicinity of Aibonito, 1937, *Pagán 577* (P.).

DISTRIBUTION: Louisiana to Florida, Bahama Islands, Cuba, Virgin Islands.

PLAGIOCHILA RUTILANS Lindenb., Spec. Hep. 47. *pl. 9, 11 & 31*. 1844. On soil and on trees. Sierra de Luquillo, 1885, *Sintenis 6* (Y.); El Yunque, 1936, *Pagán 56a* (P.); Maricao, 1937, *Pagán 212a, 215* (P.); El Yunque, 1937, *Pagán 495, 503 p.p.* (P.).

DISTRIBUTION: Brazil, Venezuela, Costa Rica, British Guiana, Trinidad, Dominica, Guadeloupe, Cuba.

PLAGIOCHILA SMALLII Evans, Bull. Torr. Bot. Club 32: 179. *pl. 5, f. 1–8*. 1905. On moist rocks. Mte. Cerrote, near Adjuntas, 1937, *Pagán 99* (P.).

DISTRIBUTION: Tropical Florida, Bermuda.

PLAGIOCHILA SUPERBA (Nees) Dumort., Recueil d'Obs. sur les Jung. 15. 1835. On rocks. El Yunque, 1937, *Pagán 541* (P.).

DISTRIBUTION: Martinique, St. Vincent, Guadeloupe, Dominica.

PLAGIOCHILA SYLVICULTRIX Spruce, Trans. & Proc. Edinb. Bot. Soc. 15: 468. 1885. Without definite date, locality or number, *Schwanecke*.

DISTRIBUTION: Guatemala, Costa Rica, Brazil, St. Kitts, Guadeloupe, Trinidad, St. Vincent.

PLAGIOCHILA TAMARISCINA Steph., Bull. Herb. Boiss. 2: 685 (Spec. Hep. 2: 222). 1902. On living trees, rotten logs and on the soil. Mte. Vega, Adjuntas, *1885, Sintenis 93* (Y., N.), under the name of *P. distinctifolia* as originally listed by Stephani; Mte. Cerrote, near Adjuntas, 1937, *Pagán 214, 220* (P.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 316* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 340*. (P.); Cerro de Punta, Jayuya, 1937, *Pagán 368* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 428, 433, 434b, 435, 437, 450 p.p.* (P.); El Yunque, 1937, *Pagán 518, 568* (P.).

DISTRIBUTION: Santo Domingo, Trinidad, Guadeloupe, Dominica, Martinique.

PLAGIOCHILA TENUIS Lindenb., Spec. Hep. 50. *pl. 10*. 1844. On trees. Without definite date, locality or number, *Schwanecke*.

DISTRIBUTION: Brazil, Venezuela, Trinidad, St. Kitts, St. Vincent, Guadeloupe, Martinique, Dominica.

PLAGIOCHILA URBANI Steph., Bull. Herb. Boiss. **5**: 362 (Spec. Hep. **2**: 530). 1905. Without definite date, locality or number, *Sintenis*.
DISTRIBUTION: Known only from Puerto Rico.

PLAGIOCHILA XALAPENSIS Gottsche, Mex. Leverm. 21. *pl. 3, f. 1–6.* 1863. Sierra de Lares, 1887, *Sintenis 128* (Y.).
DISTRIBUTION: Mexico.

(To be continued)

LICHENS OF THE UPPER WILLAMETTE VALLEY

FRANK P. SIPE

One of the distinctive features of the winter landscape in the Pacific Northwest is the luxuriant growth of lichens, particularly noticeable on the deciduous trees and shrubs. Although many collections have been made in this region, little work has been done that would indicate the exact make-up of the lichen flora.

This paper is a preliminary report on work that has been carried on during a period of years, and deals with a definite and rather natural area of Pacific Coast country. Numerous collections have been made, with the aim of learning more accurately the relative abundance and typical habitat of each species.

The area included comprises roughly the upper (south) end of the broad Willamette Valley, together with numerous tributary valleys, and the adjacent mountain land. The rough mountain land is largely covered with coniferous forest. The low hills are often occupied by deciduous oak woods. Treeless areas are in pasture or under cultivation.

The list here given furnishes: (1) A check list of the commonest lichens found in a definitely restricted area of western Oregon, and (2) brief notes on the usual habitat of each species listed. The project has been in part subsidized by grants from the General Research Council, Oregon State System of Higher Education.

ALECTORIA JUBATA (L.) Nyl. Most commonly found on oak trees.
ALECTORIA SARMENTOSA Ach. Common, and more often found on Douglas fir.
ARTHOPYRENIA GEMMATA (Ach.) Mass. On ash (*Fraxinus oregona*) forming copper-colored areas on young twigs and smooth bark.
BILIMBIA SPHAEROIDES (Dicks.) Koerb. Infrequent, on Douglas fir, in Cascade Mountains.

BUELLIA PARASEMA (Ach.) Kbr. Found on bark of various trees, especially maple.

CALOPLACA OREGENSIS H. Magn. On *Fraxinus oregona.*

CETRARIA CALIFORNICA Tuck. Fairly common on *Pinus ponderosa,* especially on dead twigs.

CETRARIA CILIARIS Ach. Abundant and conspicuous on Douglas fir.

CETRARIA GLAUCA (L.) Ach. Very abundant, growing on various trees, especially Douglas fir, on old board or rail fences in shady places, etc.

CETRARIA JUNIPERINA (L.) Ach. Seems very definitely to prefer *Pinus ponderosa* as a substrate. It is more abundant and conspicuous at higher elevations.

CETRARIA STENOPHYLLA Tuck. Grows most commonly on Douglas fir.

CETRARIA TUCKERMANII Herre. On Douglas fir, often growing with *C. stenophylla.*

CLADONIA BELLIDIFLORA (Ach.) Schaer. On much decayed logs, in deep shade, coniferous woods.

CLADONIA CARIOSA (Ach.) Spreng. fo. CRIBROSA (Wallr.) Vainio. On soil in pastures and open places.

CLADONIA CRISPATA (Ach.) Flot. On outcropping rocks, in Douglas fir forest.

CLADONIA DEFORMIS Hoffm. On rotting logs, in mixed oak and conifer forest.

CLADONIA ECMOCYNA Nyl. On outcropping rocks, Douglas fir forest, in the Cascade Mountains.

CLADONIA FURCATA (Huds.) Schrad. This *Cladonia,* together with its varieties and forms, is common among mosses on the forest floor, in mixed and coniferous woods.

CLADONIA MAJOR (Hag.) Sandst. On soil or decaying rocks, usually in sunny places in the forest.

CLADONIA NEMOXYNA (Ach.) Nyl. On soil, open sunny hillslopes.

CLADONIA PYXIDATA (L.) Fries. On soil, often in poorly drained locations.

CLADONIA POLYDACTYLA Flk. On well-rotted logs or stumps, usually in shady locations in coniferous forests.

CLADONIA SQUAMOSA (Scop.) Hoffm. var. MULTIBRACHIATA (Floerke) Vainio. On decayed stumps, in coniferous forest.

CROCYNIA LANUGINOSA Hue. Forms conspicuous gray patches over mosses, in mountains.

CYPHELIUM INQUINANS (Sm.) Trevis. Common on old weathered fence posts and board fences.

EVERNIA PRUNASTRI (L.) Ach. Very common, usually on oaks or other deciduous trees.

GRAPHIS ELEGANS (J. E. Smith) Ach. On smooth bark of *Alnus oregona.*

ICMADOPHILA AERUGINOSA (Scop.) Mass. Common on well rotted logs and stumps in the forest.

LECANORA PALLIDA (Schreb.) Schaer. Common on smooth-barked deciduous trees.

LECANORA RUPICOLA (L.) Zahlbr. Common on small outcropping rocks in open fields and on hillslopes.

LECANORA SUBFUSCA (L.) Ach. On smooth-barked deciduous trees.

LECIDEA PARASEMA Ach. Common on smooth-barked deciduous trees.

LEPRARIA CANDELARIS (L.) Fr. Forms conspicuous yellow patches on both dead and living trees.

LEPTOGIUM CALIFORNICUM Tuck. Found usually among mosses on rocks, logs, etc.

LEPTOGIUM LICHENOIDES (L.) Zahlb. Among mosses, on rocks and trees, in fields or in deciduous woods.

LEPTOGIUM PALMATUM (Huds.) Mont. Abundant, forming conspicuous dark brown patches among dead grasses along roadsides and in open fields.

LEPTOGIUM SATURNINUM (Dicks.) Nyl. Found especially on *Quercus Garryana*, growing among mosses on the tree trunks.

LEPTOGIUM SINUATUM (Huds.) Sandst. Among mosses on various trees.

LETHARIA VULPINA (L.) Vainio. Widespread, but especially conspicuous on old board and rail fences.

NEPHROMA HELVETICUM Ach. Mostly on oak, ash, and maple limbs.

NEPHROMA LUSITANICUM Schaer. On various deciduous shrubs in coniferous forest.

OCHROLECHIA OREGENSIS H. Magn. On bark of mature Douglas fir, in the coniferous forest of the Cascade Mountains.

OCHROLECHIA PALLESCENS (L.) Mass. On bark of several species of trees. Usually found in Douglas fir forest.

OCHROLECHIA TARTAREA (L.) Mass. Forms very conspicuous gray patches on *Quercus Garryana.*

OPEGRAPHA VARIA Pers. Especially common on rough bark of mature *Populus trichocarpa.*

PARMELIA CONSPERSA (Ehrh.) Ach. Conspicuous and showy on small outcropping rocks in open fields or oak forest.

PARMELIA FLAVICANS Tuck. Growing in mats of *Selaginella* on open rocky slopes.

PARMELIA OLIVACEA (Ehrh.) Ach. Common on smooth barked trees, especially ash, hawthorn, and wild crabapple.

PARMELIA PHYSODES (L.) Ach. Abundant; most common on Douglas fir.

PARMELIA SAXATILIS (L.) Ach. Most frequent on moss-covered rocks in the woods.

PARMELIA SULCATA Tayl. Can always be found on the limbs of *Quercus Garryana,* which seems to be its favorite habitat.

PARMELIELLA CORALLINOIDES (Hoffm.) Zahlbr. Found on *Libocedrus decurrens,* in dense coniferous forests of the Cascades.

PELTIGERA APHTHOSA (L.) Hoffm. Especially common growing among mosses on the forest floor, or on decaying logs, in the coniferous forest.

PELTIGERA CANINA (L.) Hoffm. On soil among grasses.

PELTIGERA POLYDACTYLA (Neck.) Hoffm. Common, on mosses, soil, base of trees, etc.

PELTIGERA PRAETEXTATA (Sommerf.) Vainio. Among mosses, in forest.

PELTIGERA SCUTATA (Dicks.) Duby. On trees, most commonly in deciduous forest.

PELTIGERA VENOSA (L.) Baumg. On soil, especially noticeable on recently graded roadside banks in the forest.

PERTUSARIA AMARA (Ach.) Nyl. Forms conspicuous gray patches on the trunks of *Quercus Garryana.*

PERTUSARIA AMBIGENS (Nyl.) Tuck. Especially abundant on bark of Douglas fir, usually giving young fir trees a characteristic mottling.

PERTUSARIA PUSTULATA (Ach.) Duby. On ash, and other smooth-barked trees.

PHYSCIA PULVERULENTA (Schreb.) Nyl. Common on rough bark of *Quercus Garryana.*

PILOPHORUS CEREOLUS (Ach.) T. Fries. On outcropping rocks throughout the mountains.

PSORA OSTREATA Hoffm. On rotted logs in oak woods.

RAMALINA DILACERATA (Hoffm.) Vainio. On oak, ash, and other deciduous trees.

RAMALINA FARINACEA (L.) Ach. On limbs of various trees in deciduous forest.

RAMALINA RETICULATA (Noehd.) Kremph. Hangs in long conspicuous strands from various deciduous trees, especially oak and ash.

SPHAEROPHORUS GLOBOSUS (Huds.) Vainio. Very common especially on the trunk and main branches of large Douglas fir.

STEREOCAULON BOTRYOSUM Ach. On rocks in the Cascade Mountains.

STICTA ANTHRAPSIS Ach. Abundant on limbs of trees in deciduous forest.

STICTA CROCATA (L.) Ach. Fairly common on limbs in deciduous forest.

STICTA FULIGINOSA (Dicks.) Ach. On oaks.

STICTA HALLII Tuck. On oaks.

STICTA LIMBATA (Smith) Ach. This species, with the four preceding species, make up a conspicuous part of the lichen flora of the oak woods.

STICTA OREGONA Tuck. On limbs of conifers, from which it falls in

karge masses when wet. These greenish-gray masses constitute a characteristic feature of the forest floor in winter.

STICTA PULMONARIA (L.) Bir. Very common; most abundant on deciduous trees growing in the coniferous forest.

STICTA VERRUCOSA (Huds.) Fink. On oaks, in the deciduous forest.

SYNECHOBLASTUS RUPESTRIS (Swartz) Trev. On bark, especially *Quercus Garryana.*

THELOCHISTES POLYCARPUS (Ehrh.) Tuck. On twigs of various deciduous trees and shrubs.

USNEA BARBATA (L.) E. Fries. On various deciduous trees.

USNEA PLICATA (L.) Wigg. Common and conspicuous on deciduous trees.

XANTHORIA OREGANA Gyel. On deciduous trees.

UNIVERSITY OF OREGON,
EUGENE, OREGON.

GYROWEISIA TENUIS IN NORTH AMERICA[1]

WILLIAM CAMPBELL STEERE

At the end of the 1937 Sullivant Moss Society Foray (Conard, 1938), Dr. A. J. Sharp and I decided to continue field work in the Upper Peninsula of Michigan. On September 2, we visited a long-abandoned stone quarry in Houghton County just north of Jacobsville, at the east or Portage Entry to the ship canal which bisects the Keweenaw Peninsula.

In joints and crevices of the sheer cliffs of soft, red, Cambrian sandstone were growing thin tufts and scattered individual plants of a very small moss which neither of us recognized at the time. Because of the undeveloped peristome and very blunt leaves, we hazarded the guess that it might be a depauperate form of *Tortula obtusifolia* Schleich., a rather common moss in northern Michigan, on calcareous sandstone.

When opportunity arose to study this unfamiliar moss, difficulty was encountered in learning its identity, because of its small size and because it is not included in any of the manuals of North American mosses. Through the use of European manuals, however, the specimens were finally identified as *Gyroweisia tenuis* (Hedw.) Schimp., an identification with which Dr. Andrews and Dr. Grout (1938) later agreed.

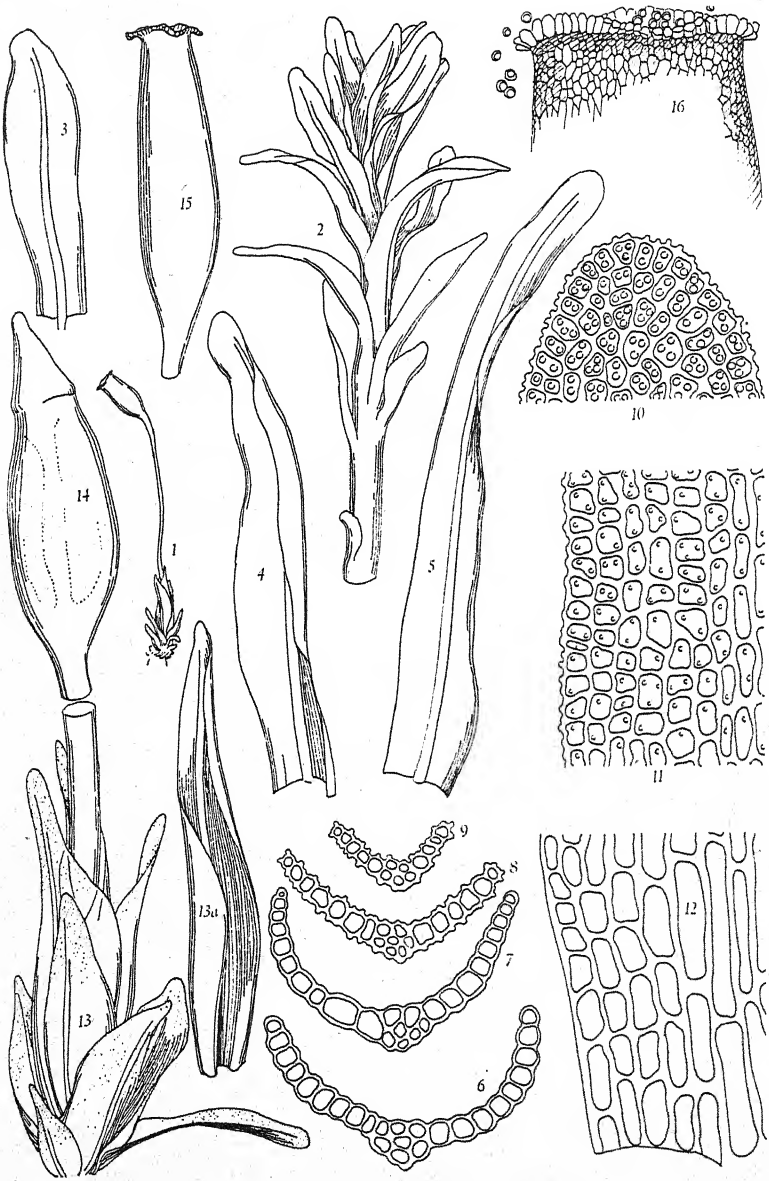
During the following year, as opportunity offered, careful compari-

[1] Papers from the Department of Botany and the Herbarium of the University of Michigan, No. 678.

sons of the Michigan specimens with material in the Herbarium of the University of Michigan, the Herbarium of the New York Botanical Garden, and the U. S. National Herbarium confirmed this identification beyond any reasonable doubt, in spite of certain minor discrepancies. For instance, in the American specimens the capsules are generally darker in color and seem to be thicker-walled. As a result, the large persistent annulus shows up much better in European material because of its contrast to the paler capsules. Also, the perichaetial leaves are larger, more acute, and more convolute than in the European specimens. Furthermore, the propagula reported for European specimens (Malta, 1931) seem to be lacking here.

Although there are decided differences between American and European specimens of *Gyroweisia tenuis*, especially in the characteristics just pointed out, the differences are not too constant. Almost completely intergrading forms are too numerous to justify any nomenclatorial recognition for our Michigan plant, as it differs in no greater degree from European material than many other mosses considered to be common to the two continents, hence conspecific.

Gyroweisia tenuis has been reported previously from North America several times. The original report from North America was based on the material collected by Drummond on "Limestone rocks at Lake Winipeg" and later distributed by him as number 21 (as *Gymnostomum tenue* Hedw.) in his "Musci Americani." Some question has been raised concerning the identity of this material. Wilson (1841), in a series of remarks on Drummond's collections, said: "21. *G. tenue.*— This may be G. calcareum Bridel . . . A solitary specimen examined had the operculum conico-subulate, two thirds the length of the capsule." Dr. A. LeRoy Andrews (1922) has examined the same material much more carefully and has arrived at the same conclusion. Much of the difficulty in interpreting Drummond's specimens lies in the fact that number 21 was issued as ten to twenty individual, fertile specimens glued to a small piece of paper. The specimens were apparently well past their prime when gathered, being old, weathered and almost uniformly deoperculate at the time of their distribution, and over a hundred years existence in herbaria has added still more to their dilapidated appearance. I examined several capsules from the two separate sets of Drummond's number 21, from the Mitten Herbarium, which are now in the Herbarium of the New York Botanical Garden, and still more from the same number in the Herbarium of



GYROWEISIA TENUIS (HEDW.) SCHIMP.

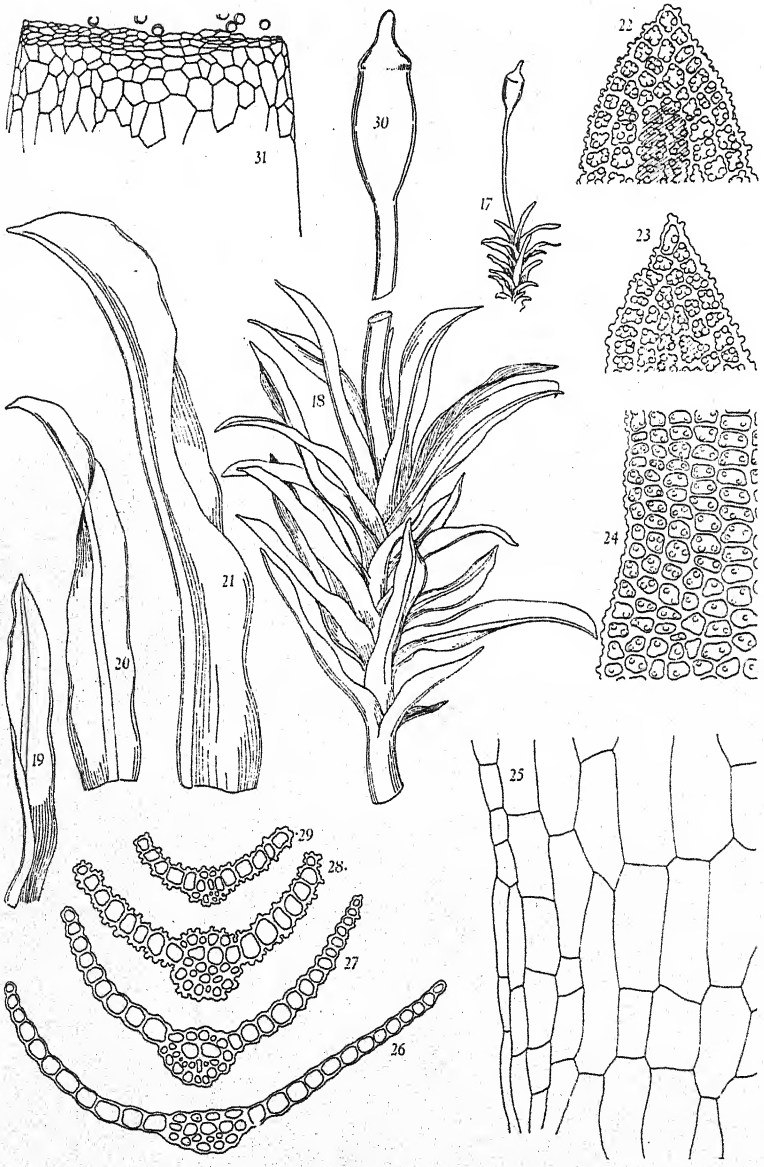
the University of Michigan. I was able to demonstrate to my satisfaction traces of the persistent annulus characteristic of the genus *Gyroweisia*, and also the sheathing perichaetium, so that in my opinion, at least, Drummond, probably with the help of Sir William Hooker, identified his material correctly.

Much later, two collections were reported as *Gymnostomum tenue* by Macoun (1892) "On the 'Great Trent Boulder' three miles above the Railway Bridge (west side) near Trenton, Ont., 1866," and from "Calcareous rocks at Owen Sound, Ont., 1871." Still later, Macoun (1902) reported a further collection from "Damp limestone rocks at Credit Forks, Ont., 1893." Here, however, he also referred the specimen previously reported from Owen Sound to Kindberg's *G. pusilla*, which from the "perichaetial [leaves] not larger and not sheathing," as well as in its other characteristics is rather clearly *Gymnostomum calcareum*, where it has also been placed very recently by Grout (1938). The other specimens reported by Macoun also represent *Gymnostomum calcareum*, according to Andrews (1922).

The most recent report of *Gyroweisia* in North America is that of Moxley (1930), although he later referred his specimen to *Gymnostomum calcareum* var. *intermedium* and does not include *Gyroweisia* in his interesting list (1932) of species from North Grey County and the Bruce Peninsula.

In reviewing this history of *Gyroweisia* in North America and in looking over the numerous specimens so identified in various herbaria, I was impressed by the almost general confusion of several other species with *Gyroweisia tenuis*, even in Europe, where the species is relatively much more common. Sterile plants of *Diphyscium foliosum* (Hedw.) Mohr, which have puzzled nearly every bryologist at some time in his career, were formally issued as "*Gyroweisia tenuis*" in Holzinger's "Musci Acrocarpi Boreali-Americani," number 331. Although the leaves of both mosses are noticeably blunt, the larger size, usually darker color, and different areolation, with the cells arranged conspicuously in parallel rows, will serve to distinguish the *Diphyscium*.

FIGS. 1–16. GYROWEISIA TENUIS. 1. Whole fertile plant, showing highly differentiated perichaetial leaves, × 3. 2. Sterile plant, × 25. 3–5. Individual leaves, progressively longer from base to apex of stem, × 45. 6–9. Cross sections of leaves, from base to apex of leaf, × 380. 10. Areolation of leaf apex, × 380. 11. Areolation of leaf margin about half way between base and apex, × 380. 12. Areolation of leaf base, × 380. 13. Perichaetium, × 45. 13a. Single perichaetial leaf, × 45. 14. Operculate capsule, × 45. 15. Deoperculate capsule, × 45. 16. Mouth of deoperculate capsule, showing persistent annulus, and spores, × 110.



GYMNOSTOMUM CALCAREUM NEES ET HORNSCH

However, *Gymnostomum calcareum* Nees et Hornsch. is the species most frequently identified as *Gyroweisia tenuis,* and so this opportunity will be taken to compare the two mosses. As illustrations of *Gyroweisia* have never been made from American material, and as *Gymnostomum calcareum* has only been illustrated once from American specimens (Jennings, 1913), so far as I can determine, illustrations of both species are provided here, through the skill of Miss Olivia Embrey.

The two mosses differ in many ways in both gametophytic and sporophytic characteristics. In the leaf of *Gyroweisia tenuis* the costa ends well below the blunt, rounded apex (Fig. 10); in *Gymnostomum calcareum* the costa ends in the generally acute apex (Figs. 22 and 23). The upper leaf cells of both species are of about the same dimensions, 8–10 μ in diameter, rather clear and transparent in *Gyroweisia,* but very much more papillose in the *Gymnostomum* and consequently obscure, giving the illusion of being much smaller. The lowermost cells in the *Gymnostomum* are hyaline, thin-walled, and much larger than the upper leaf cells (compare Figs. 25 and 24), reaching 25–35 μ in length, whereas in *Gyroweisia* the basal cells are thick-walled, chlorophyllose, and not as large as in the other species (compare Figs. 12 and 11). In cross sections of the leaves, the costa in the two mosses appears very different, being almost homogeneous in *Gyroweisia* (Figs. 6–9) but having well differentiated stereids and guide cells in the *Gymnostomum* (Figs. 26–29). Differences in the structure of the stem in cross section, also, have been pointed out (Andrews, 1922). Examination of a large series of specimens shows the presence or absence of a central strand in the stem to be inconstant. Hilpert (1933) has shown that in the family the development of a central strand depends in large part on environmental conditions, and so is not safely used as a diagnostic criterion. As for macroscopic differences, the most conspicuous in the gametophyte is the well-developed perichaetium of *Gyroweisia* (Figs. 1 and 13), which is completely lacking in the *Gymnostomum* (Figs. 17 and 18).

The sporophytes of the two mosses are also characteristically different, although of approximately the same size. The capsule of

FIGS. 17–31. GYMNOSTOMUM CALCAREUM. 17. Whole fertile plant, × 3. 18. Whole fertile plant, × 25, showing undifferentiated perichaetial leaves. 19–21. Individual leaves, progressively longer from base to apex of stem, × 45. 22–23. Areolation of the apex of two different leaves, × 380. 24. Areolation of the leaf margin at about mid-leaf, × 380. 25. Areolation of leaf base, × 380. 26–29. Cross sections of leaf from base to apex, × 380. 30. Operculate capsule, × 45. 31. Mouth of deoperculate capsule, showing marginal cells and spores, × 110.

Gymnostomum calcareum (Figs. 17 and 30) is ovate, the urn is a clear, light brown, but a few rows of cells at the mouth are conspicuously red. The capsule of *Gyroweisia* (Figs. 1, 14 and 15) is longer, elliptical to oblong, and much contracted below the flaring mouth. The unique annulus which characterizes *Gyroweisia* (Fig. 16) is most conspicuous when moist, and can then be seen with a hand-lens. The cells at the mouth of the capsule, below the annulus, differ in form and size, as the accompanying illustrations show very well (compare Figs. 16 and 31). The spores, however, are of very much the same size and appearance.

After some correspondence with Mr. E. A. Moxley on the subject of *Gyroweisia* in the vicinity of Owen Sound, he sent me for identification a moss from there marked "Barbula?" which by a curious coincidence turned out to very good material of *Gyroweisia tenuis*.

Consequently, the present known distribution of *Gyroweisia tenuis* (Hedw.) Schimp. in North America is based on three specimens, as follows: MANITOBA: "Limestone rocks of Lake Winipeg," *Thomas Drummond*, 1825 (Franklin, 1828). MICHIGAN: On north-facing cliff of red Cambrian sandstone in quarry just north of Jacobsville, Houghton County, *W. C. Steere* and *A. J. Sharp*, September 2, 1937; *W. C. Steere*, September 1, 1938. ONTARIO: Owen Sound, North Grey County, *E. A. Moxley*, May 24, 1934. A remarkable feature of the disjunct geographical distribution of *Gyroweisia tenuis* just outlined is that of the three localities in which it has been collected, two are already famous for furnishing other species with curious geographical ranges. Many species of bryophytes and higher plants which are otherwise known only much farther west or much farther north inhabit both the Bruce Peninsula of Ontario (Moxley, 1932) and the Keweenaw Peninsula of Michigan (Steere, 1937, 1938). No special collecting of Bryophyta has been done in the vicinity of Lake Winnipeg since the days of Drummond as a member of Franklin's second Land Arctic Expedition, yet it is perhaps safe to predict that this area, too, will be found to contain many other plants of critical geographical distribution.

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HEPATICAE OF SIERRA ANCHA, ARIZONA

ELBERT L. LITTLE, JR.[1]

Sixteen species of Hepaticae of Sierra Ancha, in central Arizona, are represented in a collection made by the author as a spare-time study from 1935 to 1937. As five of these apparently have not been reported previously from the State, the State list is increased to twenty-seven species.

In a preliminary list of Arizona Hepaticae, Evans (4) recorded twenty-one species, based largely upon collections made by G. E. Nichols in 1913. Most of the specimens, including sixteen species, were from Santa Catalina Mountains of southern Arizona, about 100 miles south of Sierra Ancha. Howe (Grout, 5, p. 278) cited an additional species, *Porella platyphylloidea*, from Arizona.

Sierra Ancha is located within Tonto National Forest in Gila County, by air line about twenty-five miles north of Globe and fifteen miles northeast of Roosevelt Dam. From an elevation of about 2,100 feet above sea level at Roosevelt Reservoir it rises gradually to about 7,800 feet at the summit. It is composed mainly of quartzite with intrusions of diabase and small outcrops of sandstone and limestone.

[1] Assistant forest ecologist, Southwestern Forest and Range Experiment Station, which is maintained at Tucson, Arizona, by the Forest Service, United States Department of Agriculture.

Three climatic or life zones with their distinctive vegetation are represented here: (1) semidesert, or Lower Sonoran life zone, up to an elevation of about 3,500 feet; (2) chaparral-woodland, or Upper Sonoran zone, from about 3,500 feet to 6,000 feet; and (3) pine-fir forest, or transition zone, above 6,000 feet. Nearly all the collecting was done in Sierra Ancha Experimental Forest, a branch of the Southwestern Forest and Range Experiment Station, headquarters of which is located at an elevation of about 5,000 feet on the southwest side of the mountain. All the specimens except those of *Riccia Frostii* were obtained within a five-mile radius of this point.

In relative numbers hepatics are rare on Sierra Ancha and insignificant in composing the vegetation, but certain species are common locally and seasonally. They are distributed from the exposed bed of Roosevelt Reservoir, where members of the species *Riccia Frostii* are found, to the highest point of Sierra Ancha, where the species *Frullania inflata* and *Radula complanata* are represented. Principal habitats are rock outcrops and moist soils, such as on rock ledges where there is seepage and near streams. Liverworts of only one species, *Frullania inflata*, were observed growing on tree trunks.

The best display of Hepaticae on Sierra Ancha occurs in early spring in the chaparral-woodland zone. Here liverworts grow on shallow soils upon exposed quartzite ledges kept moist by seepage from heavy winter rains. They start growth in January or earlier, mature and form spores usually by the end of March, and become dormant or die shortly afterwards as the soils become dry. *Mannia californica* and *Fossombronia longiseta* are the species most commonly represented on these sites, and individuals of *Riccia* spp. are found here in fewer numbers.

Evans (4) noted that the large proportion of thalloid species in Arizona indicates the strongly xerophilous character of the hepatic flora. Of the sixteen species of hepatics on Sierra Ancha, only four are leafy and the rest are thalloid. Campbell (2) observed that drought-resistant thalloid liverworts in California, including those of species represented also on Sierra Ancha, are perennial but remain dormant during the dry season. Cannon (3) demonstrated that thalli of *Plagiochasma* sp. at Tucson, Ariz., were capable of enduring great loss in water content amounting to seventy to eighty percent of weights of moist plants. The xerophytic thalloid hepatics on Sierra Ancha doubtless react to dry periods as do those studied by Campbell

and Cannon. During the rainy season of midsummer, most hepatics here stay dormant and do not resume growth until winter rains begin.

From a comparison of lists from bordering states, Evans (4) concluded that a close relationship exists between the species of Arizona and those of California and Mexico. In geographic distribution the Hepaticae of Sierra Ancha are principally species of the semiarid Southwest. All except three of the species of Sierra Ancha were recorded from California by Howe (6). Only about half the species, including all five species of the pine-fir forest zone, are represented also in eastern United States.

Detailed collections in the high mountains of northern New Mexico by the late Brother Arsène (1) increased the number of species of Hepaticae in that state to twenty-eight. Eleven of these are listed from Arizona also, and the two states together have forty-four species. While more species are expected to be found common to both states, the character of the lists reveals differences in habitats. New Mexico has eighteen species of leafy liverworts and only ten of thalloid liverworts, while Arizona has eight species of leafy hepatics and nineteen of thalloid. Leafy forms of the order Jungermanniales are better represented in the more humid, cooler zones of high mountains, which are more extensive in New Mexico than in Arizona. Thalloid hepatics, on the other hand, are more numerous in the drier, warmer zones, which are more widespread in Arizona.

The list of sixteen species of Hepaticae of Sierra Ancha, Arizona, with brief notes follows. *Riccia* is represented by five species and the other eleven genera by a single species each. The five state records are indicated by asterisks (*). Specimens from the Hepatic Herbarium of the Sullivant Moss Society, which were lent by Dr. Margaret Fulford, were used in making determinations. Dr. Alexander W. Evans has kindly determined the specimen of *Cephaloziella papillosa* and has verified the author's determinations of a few other specimens. Duplicate sets of the Hepaticae of Sierra Ancha, Arizona, have been deposited in herbaria of the U. S. Forest Service at Washington, D. C., and Sierra Ancha Experimental Forest, and in the herbaria of the Sullivant Moss Society, Yale University, and University of Arizona.

RICCIACEAE

*RICCIA CRYSTALLINA L. Rare on moist soils, chaparral-woodland zone; spring.

*RICCIA FROSTII Aust. Abundant on moist soils recently exposed

along Salt River by lowering of level of Roosevelt Reservoir, semidesert zone, Aug. 24, 1936.

Apparently a characteristic habitat of this species is denuded, moist soils along streams. The author has found plants common in similar areas along Rio Grande in New Mexico and Arkansas River in Oklahoma.

*RICCIA NIGRELLA DC. Uncommon on moist, shallow soils on quartzite ledges, chaparral-woodland zone; spring.

RICCIA SOROCARPA Bisch. Rare on moist, shallow soils on quartzite outcrops, chaparral-woodland zone; spring.

*RICCIA TRICHOCARPA M. A. Howe. Rare in crevices of quartzite, chaparral-woodland zone; spring.

TARGIONIACEAE

TARGIONIA HYPOPHYLLA L. Rare on quartzite and diabase outcrops, semidesert and chaparral-woodland zones, spring.

REBOULIACEAE

ASTERELLA CALIFORNICA (Hampe) Underw. Uncommon on moist soils and diabase ledges, semidesert zone, spring.

Collection of carpocephala confirms Evans' (4) doubtful Arizona record based upon sterile specimens.

MANNIA CALIFORNICA (Gottsche) Wheeler. (*Grimaldia californica* Gottsche.) Common on moist quartzite ledges and occasionally found on moist soils, chaparral-woodland zone, spring.

This is the species of Hepaticae most commonly represented on Sierra Ancha. The perennial thalli grow only in winter and spring and mature archegonial receptacles from February to April. The rest of the year the thalli are tightly inrolled with the purplish-black ventral scales exposed. This record confirms Evans' (4) report based upon provisional determination of sterile Arizona specimens.

REBOULIA HEMISPHAERICA (L.) Raddi. Uncommon on sandstone and quartzite ledges, chaparral-woodland and pine-fir forest zones.

MARCHANTIACEAE

MARCHANTIA POLYMORPHA L. Uncommon on moist, shaded soils along a small stream, pine-fir forest zone.

Thalli perennial and evergreen. Archegonial receptacles mature in summer.

PELLIACEAE

FOSSOMBRONIA LONGISETA Aust. Common locally on moist soils

on quartzite and diabase ledges, chaparral-woodland and semidesert zones; spring.

The light green, ruffled, leaf-like thalli often form large mats.

CEPHALOZIELLACEAE

CEPHALOZIELLA PAPILLOSA (Douin) Schiffn. Rare in shaded crevices of quartzite cliffs, chaparral-woodland zone.

RADULACEAE

RADULA COMPLANATA (L.) Dumort. Common locally on shaded sandstone boulders and cliffs, pine-fir forest zone. Sporophytes produced in spring.

PORELLACEAE

PORELLA PLATYPHYLLOIDEA (Schwein.) Lindb. Uncommon on shaded sandstone bluffs, pine-fir forest zone.

LEJEUNEACEAE

FRULLANIA INFLATA Lehm. & Lindenb. Common locally on shaded sandstone boulders and cliffs and trunks of trees (*Quercus utahensis*, *Q. chrysolepis* var. *Palmeri*, and *Acer grandidentatum*), pine-fir forest zone. Sporophytes produced in spring.

ANTHOCEROTACEAE

*ANTHOCEROS FUSIFORMIS Aust. Rare on moist, shaded soils near springs, chaparral-woodland zone. Sporophytes mature in early summer.

SUMMARY

Sixteen species of Hepaticae including five state records are represented in a collection made by the author on Sierra Ancha in central Arizona from 1935 to 1937. Only four of these species are leafy and the rest are thalloid, mostly xerophytic forms.

TUCSON, ARIZONA

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A COLLECTING TRIP ON MOUNT MONADNOCK, NEW HAMPSHIRE

INEZ M. HARING

On the morning of August 1st, Dr. Grout, Mrs. Grout and I drove to the half-way house on Mt. Monadnock, N. H. Our intention was to give the mountain in that vicinity a casual glance for mosses and come back later to do the real collecting. After leaving the hotel we at once began to find both the trail and the mosses very enticing and interesting, so continued climbing until the summit was reached.

Mt. Monadnock, with an altitude of 3,186 feet, is wooded until close to the top, when it becomes rugged and rocky, with no trees and only a small amount of vegetation. The trail up to the open rocky area is apparently a stream bed in wet weather and even in August there is a slight trickle of water through it.

From about 2,000 ft. along this trail until the open section is reached, *Atrichum crispum* (James) Sull. grew in abundance, sometimes in the trail and sometimes among the rocks at the side of the trail. Within the first three quarters of a mile we picked up three *Rhacomitriums—R. aciculare* (L.) Brid., *R. fasciculare* (Schrad.) Brid. and *R. heterostichum* (Hedw.) Brid. var. **ramulosum** (Lindb.) n. comb. On the rocks at about 2,000 ft. along the trail was *Andreaea rupestris* Hedw. while at about 3,000 ft. I found *Andreaea Rothii* Web. & Mohr. on the side of the massive rocks, where some moisture seeped through. On the boulders from about 2,300 to 3,000 ft. *Dicranum longifolium* Ehrh. was abundant, sometimes being in fruit. Just before entering the rocky area at about 2,800 ft. Dr. Grout made the real find of the day, *Leptodictyum vacillans* (Sull.) Broth., growing profusely in mats near the spring. Above and a few feet beyond, on the open face of the rocks, I gathered *Oncophorus polycarpus* (Hedw.) Brid. var. **strumiferus** (DeNot) n. comb. not in abundance, but apparently finding its habitat in the crevices of the rocks. Within a short distance of the top, turning off to the right of the trail, we explored the border of a small basin of water. Here and in fruit *Polytrichum strictum* Banks grew in fair abundance along the edge of the water. On the summit at an altitude of 3,186 ft. Dr. Grout collected *Pogonatum capillare* (Mx.) Brid.

The above list does not include the more common mosses that we saw and represents the results of a trip of about four hours from beginning to end, covering only the area near the trail. The mountain is worthy of a much more detailed study.

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CONTENTS

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NOTES ON SOUTHERN HEPATICAE

H. L. BLOMQUIST

Since the publication of the report on the Hepaticae of North Carolina two years ago,[1] continued collecting has brought in two species new to the state and extended the local ranges of many others. As the specimens of the Hepaticae new to the state represent general range extensions, it has seemed worth-while to submit these records together with the more important range extensions within the state, especially of those species for which there was but a single record in the previous report. In addition to the collections from North Carolina, some interesting Hepaticae have been received from the states farther south, especially from Georgia and Mississippi. As some of these also represent new records for the respective states and general range extensions, they are included in this paper.

In the identification of some of these specimens Dr. Evans has lent kind assistance for which the writer wishes to express his grateful appreciation.

NORTH CAROLINA

BLASIA PUSILLA L. Collected on a moist clay road bank near Sharp's Falls Power Dam, between Warrensville and Creston, along the west branch of New River, Ashe County, by Blomquist and Anderson, September 7, 1937, *10,007*. The growth was conspicuous because of its luxuriant, dark green color, resembling a pure stand of some species of *Anthoceros*. The plants bore the interesting flask-shaped gemmae receptacles in abundance. This is, so far as we

[1] THE BRYOLOGIST 39: 49–67. 1936

know, the first collection from North Carolina, which is now the southern limit of the known distribution of *Blasia* in the Atlantic States. It ranges in this country from New England across the continent to Washington, Oregon and California, and in the eastern states has been found previously as far south as Virginia. It also occurs in Europe and Asia.

LOPHOZIA BARBATA (Schmid.) Dumort. Collected at base of rock, summit of Nigger Mt., Ashe County, by Blomquist and Anderson, September 7, 1937, *9999*. This hepatic was listed by M. A. Curtis in his catalogue of plants of North Carolina[1] as "*Jungermannia barbata* Schreb. Up. [upper district] (Sull.) Earth and rocks," but as no specimen could be located upon which this report was based, the species was not included in the previous list. Therefore, so far as is known, this is the only collection of the species from the state. Our collection also represents the most southern record of the occurrence of the species in the eastern states and a noteworthy extension of its known range, not having been collected previously south of New Jersey in the East, Indiana in the Middle States, and Montana and Washington in the West. It has, however, been recorded as far south as Colorado. The species is distinctly northern in its distribution, having been found as far north as Alaska and Greenland. In Europe and Asia it ranges from Siberia to the island of Corsica.

It is interesting to note that Nigger Mt. is also the southern range limit of the fern *Woodsia ilvensis* (L.) R. Br. which was found here by Asa Gray in 1841 and has recently been relocated by E. T. Wherry (1935).

LOPHOZIA BICRENATA (Schmid.) Dumort. Collected by the writer in two new localities in the lower piedmont near Durham, Durham County, February 28, 1938, *10,216*, and at Lake View, Moore County, March 20, 1938, *10,220*. This species was previously represented by a single collection from Avery County (Andrews). These new records indicate a wide distribution in the state for this species, which occurs in sandy acid soil and is often associated with species of *Cephaloziella* and with *Odontoschisma prostratum*.

ACROBOLUS RHIZOPHYLLUS Sharp, THE BRYOLOGIST **39**: 1–2. 1936. Collected on moist boulder, Chatooga River, Macon County by A. J. Sharp and H. C. Bold, July 3, 1938, *38,120*. The only record of this interesting and recently described hepatic from the state was from

[1] Geol. and Nat. Hist. Surv. N. C. Pt. III, p. 76. 1867.

Soco Falls in the extreme northwestern corner of Jackson County. The new record places its range considerably farther south.

GEORGIA

RICCIA DONNELLII Aust., Bull. Torrey Club **6**: 157. 1877. Collected in sandy soil around flat granite outcrops at Echol's Mill, eleven miles northeast of Lexington, Oglethorpe County, by J. H. Pyron and Rogers McVaugh, February 15, 1938. This is the first record for Georgia and indicates the present known northern limit of distribution. This species was discovered for the first time by J. Donnell Smith at Jacksonville, Florida, in 1877. Since then it has also been collected in Texas. It has been well illustrated by Haynes.[1]

GRIMALDIA FRAGRANS (Balb.) Corda. Collected on shallow soil on granite rocks, Cedar Rock Quarry, 4 miles east of Camak, Warren County, by Rogers McVaugh and J. H. Pyron, February 13, 1938, and at Hegge's Rock, eight miles east of Appling, Columbia County, April 10, 1938, *2541*. This species is new for Georgia and indicates the eastern limit of its range in the South, and the most southern point of occurrence in the Atlantic States. The nearest previously known locality for it is in Alabama. According to the records of this species extant, it has an interesting distribution, ranging from New England and Quebec west to Minnesota, thence south to New Mexico and from there east to Georgia. Its total absence from the other Atlantic States south of New York and from some of the other states east of the Mississippi River, presents an interesting problem in plant distribution.

MISSISSIPPI

FOSSOMBRONIA WONDRACZEKI (Corda) Dumort. Collected at Clinton, Mississippi, by Charles L. Deevers in the spring of 1938, *3*. The specimen has unusually large spores with high lamellae which make them appear prominently spiny on the margin. This record extends its range from North Carolina to Mississippi. It has been collected also in New Brunswick, New England, Pennsylvania, Maryland, West Virginia, Indiana and western Canada.

TELERANEA NEMATODES var. LONGIFOLIA M. A. Howe, Bull. Torrey Bot. Club **29**: 284. 1902. Collected at Clinton, Mississippi by Charles L. Deevers in the spring of 1938, *2*. This species is new to

[1] Torrey Bot. Club **47**: 279–280. *Pl. 10*. 1920.

the state, which becomes the western extension of its range in the South. It has previously been recorded from Long Island, Staten Island and New Jersey; North Carolina, Georgia and Florida.[1]

PETALOPHYLLUM RALFSII (Wils.) Nees. and Gottsche. Collected at Clinton, Mississippi, by Charles L. Deevers, spring of 1938, *1*. This interesting hepatic was discovered for the first time in North America at Austin, Texas in 1914.[2] Before this time it was known from England, Ireland, and some of the islands in the Mediterranean and adjacent continental regions.

DEPARTMENT OF BOTANY,
DUKE UNIVERSITY,
DURHAM, N. C.

WHAT IS LECIDEA PRINGLEI TUCKERMAN?

I. MACKENZIE LAMB

In 1936, while working in the Herbarium of the Muséum d' Histoire Naturelle, Paris, I came across a specimen labelled in handwriting which I subsequently identified as that of C. J. Sprague: "Lecidea Pringlei, Tuck. Cascade Mts. Wash. Terrij leg. Brandegee." It was obvious at the first glance that it was no *Lecidea* in any accepted delimitation of the genus, being fruticulose. I therefore photographed the entire specimen and by the kind permission of the authorities of the Muséum detached a small portion for detailed investigation.

Lecidea Pringlei was published by Tuckerman in Bull. Torrey Bot. Club, **10**: 22 (1883), two localities being mentioned: California, Sierra Nevada, leg. Pringle, and Washington Territory, Cascade Mountains, leg. Brandegee. The Paris specimen is therefore part of the latter gathering, which, in the Farlow Herbarium, Cambridge, Mass., has been designated as "co-type," although not by Tuckerman himself.[3] Whether it is identical with the collection labelled "type," from Sierra Nevada, cannot be regarded as definitely established, although, from information received and from inspection of photographs kindly sent to me, it appears highly probable that it is.

[1] Haynes, THE BRYOLOGIST **8**: 97–98. 1905.

[2] Evans, A. W. THE BRYOLOGIST **22**: 57–59. 1919.

[3] For this information regarding the specimens of this species in the Farlow and Vermont herbaria I am indebted to Prof. W. A. Setchell, and for photographs of the specimens in these herbaria to Prof. D. H. Linder and Prof. G. P. Burns respectively. To these three gentlemen I express my most cordial thanks.

In order therefore to avoid unnecessary multiplication of names, I retain the specific epithet "*Pringlei*" for the Washington Territory plant until such time as the type and co-type specimens in the Farlow herbarium may be proved to be distinct.

My investigation of the fragment removed from the Paris herbarium gave the following data:

Thallus fruticulose, 1.6–2.0 cm. high, not springing from a basal disc, but mode of adherence to substratum not apparent; copiously irregularly branched, branches terete or irregular in section, in lower three-quarters irregularly split and cariose, decorticated, pale yellowish, matt, 0.5–1.5 mm. thick; in upper quarter expanding into irregularly convolute, contorted, sometimes flattened lobes, which are corticate (the cortex easily detached), dull yellow, matt or subnitid, 0.8–1.5 mm. across, irregularly crenulate-tumid, closely adnate so as to form an almost continuous, very uneven crust, which is black and shining, and contains the apothecia.

Apothecia fairly numerous, developed terminally on upper sides of apical lobes, black, effuse, indeterminate, irregular in outline, level with the lobes on which they are developed, not limited by any raised proper or thalline margin, the black colour fading out gradually at the sides into the yellowish thalline cortex. Hymenial area 0.5–1.0 mm. across, matt when mature.

Pycnidia indicated externally by somewhat diffuse black spots 0.05–0.1 mm. diam., in upper corticate lobes of thallus, not protruding above surface.

Lower decorticated stipes of thallus homogeneous in section, composed of colourless thick-walled gelatinised hyphae 3–4 μ diam., with lumina 1 μ or less in diam., closely compacted, running in various directions, but mainly longitudinally. *Upper branches* invested with a *cortex* 25–40 μ deep, colourless or faintly yellowish throughout (in yellow parts of branches), or with a single outer layer of blue-green, isodiametric, rounded cells 3–6 μ diam. having walls 1–1.5 μ thick (in black parts of branches); composed of gelatinised, conglutinated, thick-walled, branching and anastomosing hyphae running mainly perpendicular to surface, only the lumina being visible, these 1–1.5 μ diam. Directly below the cortex is the *gonidial stratum*, interrupted, 30–70 μ deep; *gonidia* lying in clumps, but easily separable, protococcoid, 7–15 μ diam., now yellowish green, with colourless wall 1–1.5 μ thick; no pyrenoid apparent; apparently increasing by internal sporulation. *Medulla* very loose, formed of tangled branched colourless gelatinised hyphae 3–9 μ thick, with thick walls (lumina 1–1.5 μ diam.).

Hypothecium of apothecium of variable depth (8–90 μ), in some places almost absent, colourless or faintly yellowish, formed of closely intertexted, compacted, and conglutinated, indistinct, gelatinised

hyphae 3–5 μ thick, running in various directions; superimposed directly upon an interrupted gonidial stratum, which, in places where the hypothecium is almost absent, lies close below the thecium. *Thecium* grading imperceptibly into the thalline cortex, the blue-green outer cells of the latter showing a gradual transition into the blue-green apices of the paraphyses; 30–40 μ high, colourless or with a faintly yellowish or blue-green tinge. *Paraphyses* subdiscrete in water, simple or branched, 1.5–2.0 μ thick, at apices thickened up to 5 μ, and there blue-green; septate, with cells 5–9 μ long. *Asci* clavate or peg-top-shaped, 21–25 by about 12 μ; wall thin (about 1 μ), except at apex, where thickened up to 4 μ, the plasm running up into a narrow invagination. *Spores* 8 in ascus, biseriate or irregularly arranged, simple, colourless, elongate-ellipsoid, equally rounded at both ends, thin-walled, 9–9.3 by 2.8–3 μ.

Pycnidia spherical in section, immersed in thallus, 140–150 μ diam., with pale yellowish very finely cellular perifulcrium 12–24 μ thick; outer layer of cortex around ostiole of ± isodiametric rounded blue-green cells 3–6 μ diam. *Fulcra* exobasidial, simple or often branched, 4.5–13 μ long, 2–3 μ thick. *Conidia* shortly filiform, almost straight or slightly curved, 15–20 by 0.7–1.0 μ.

Reactions: Decorticated lower stipes KHO + faint dull yellow, $CaCl_2O_2$ −, Pd + lemon-yellow; cortex KHO + faint yellow, $CaCl_2O_2$ −, Pd + faint orange; loose medulla of upper branches KHO + dull yellow, $CaCl_2O_2$ −, Pd + lemon-yellow. Thecium unaltered in colour by KHO; with I, first blue, then paraphyses greenish-blue and asci wine-red. Hypothecium uncolored by I.

The systematic position of this lichen is not immediately apparent from the above description. The ease with which the cortex becomes detached from the compacted medulla of the lower stipes calls to mind the structure met with in the Usneaceae, but is more probably the result of age and weathering. In the Lecanoraceae a strong affinity as regards the fruticulose structure is shown by *Lecanora* sect. *Cladodium* Tuckerm., and it is here that in my opinion the present species may best be included. The structure of the pycnoconidial fulcra, which is intermediate between the "*Placodium*-" and the "*Parmelia*-Typus" of Glück, accords satisfactorily with this view. The chief obstacle to inclusion within this genus is the remarkable indefinite nature of the apothecial disc, shown in the section figured (Fig. 1). Here there is no trace of any proper or thalline margin, the thecium being gradually transformed at the sides into the thalline cortex, and often very irregular in outline. On this point, however, a definite ruling has been given by Zahlbruckner, in Engler & Prantl, Nat. Pflanzenfam., ed. II, 8: 127 (1926), where, writing of *Sagenidium*

Stirt., a doubtful genus of Roccellaceae, said to differ from *Roccella* only in having immarginate apothecia, he states: "wenn sonst keine Unterschiede vorhanden wären, müsste *Sagenidium* als Synonym zu *Roccella* gezogen werden."

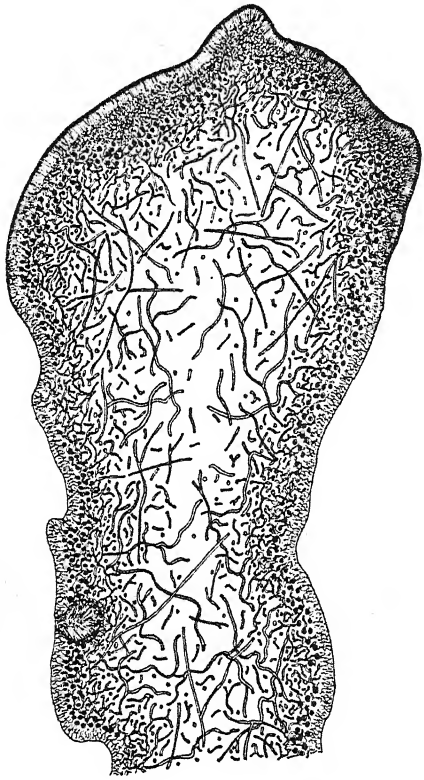

FIG. 1. "LECIDEA PRINGLEI" TUCKERM. Longitudinal section of apex of thalline branch terminated by an apothecium, × 48.

From consideration of the above evidence, it seems that "*Lecidea Pringlei*" may most suitably be included in the genus *Lecanora* (§ *Cladodium*), as *Lecanora* **Pringlei** (Tuckerm.) M. Lamb, n. comb.

Habitat: "N. America, Washington Territory, Cascade Mountains," leg. Brandegee; California, Sierra Nevada, leg. Pringle; on rocks.

The other species of this section are:

L. Bolanderi Tuckerm., Proc. Amer. Acad. Arts and Sci. **6**: 266. 1866. California.

L. **Hosseana** (Gyeln.) M. Lamb, n. comb.[1] (*Cladodium Hosseanum* Gyeln. in Fedde, Repertorium **33**: 305. 1934.) Argentina.

L. **Maheui** (Hue) M. Lamb, n. comb. (*Polycauliona Maheui* Hue apud Maheu, Bull. Soc. Bot. France **56**: 390. 1909.) Spain.

L. phryganitis Tuckerm., Lich. of California 19. 1866. California.

L. thamnitis Tuckerm., Lich. of California 20. 1866.

Doubtful species, probably belonging to *Lecanora* § *Cladodium*, but apothecia unknown: *Lecanora scythica* (Nyl.) Nyl. apud Hue, Nouv. Archiv. du Muséum Sér. III. **3**: 60. 1891. (*Squamaria scythica* Nyl., Synops. Lich. **2**: 64. 1885.) Caucasia.

BRITISH MUSEUM (NATURAL HISTORY), LONDON

RAYMOND H. TORREY (1880–1938)[2]

The recent death of the Curator of Cladoniae of the Sullivant Moss Society has dealt a real blow to our Society. Mr. Torrey was born in Georgetown, Massachusetts, July 15, 1880, and died in New York City this past summer on his fifty-eighth birthday. Although not a professional botanist, Mr. Torrey had an energetic and enthusiastic interest both in botany and in conservation which won him recognition and brought him to leadership in these fields. He had been active not only in the affairs of our Society, but also in those of the Torrey Botanical Club, of which he was President at the time of his death. Since 1935 he had been a member of the Board of Managers of the New York Botanical Garden. For those who wish more detailed information concerning Mr. Torrey's life and work, we recommend the illuminating accounts which have appeared in Torreya (**38**: 108–110), the Journal of the New York Botanical Garden (**39**: 188–189), and the Bulletin of the Torrey Botanical Club (**65**: 433–438), this latter with portrait and bibliography.—W. C. S.

[1] *Cladodium* cannot stand as a generic name, as it is invalidated by the moss genus *Cladodium* Brid., Bryol. Univ. **1**: 620. 1826.

[2] The portrait of Mr. Torrey which prefaces this issue was furnished through the kindness of Mr. A. T. Beals and is an enlargement from a film belonging to Miss Ora B. Smith.

RAYMOND H. TORREY (1880–1938)

A PRELIMINARY LIST OF THE HEPATICAE OF PUERTO RICO INCLUDING VIEQUES AND MONA ISLAND

F. M. PAGÁN

(*Continued from page 12*)

SYZYGIELLA LAEVIGATA (Spruce) Steph., Hedwigia **34**: 239. 1895. Without definite date, locality or number, *Sintenis*.

DISTRIBUTION: West Indies.

SYZYGIELLA PERFOLIATA (Sw.) Spruce, Jour. Bot. **14**: 234. 1876. On trees and on rocks. Sierra de Luquillo, 1885, *Sintenis 19* (Y., F.); Sierra de Luquillo, 1912, *Bro. Hioram, without number* (Y.); summit of El Yunque, 1937, *Pagán 514* (P.).

DISTRIBUTION: Jamaica.

SYZYGIELLA RUBRICAULIS (Nees) Steph. Bull. Herb. Boiss. **2**: 468 (Spec. Hep. **2**: 187). 1902. Without definite date, locality or number, *Sintenis* (N.).

DISTRIBUTION: Brazil, Venezuela, Costa Rica.

TYLIMANTHUS MARGINATUS Steph., Bull. Herb. Boiss. **5**: 1133 (Spec. Hep. **3**: 5). 1905. Without definite date, locality or number, *Sintenis*.

DISTRIBUTION: Guadeloupe, Martinique, Dominica.

TRIGONANTHACEAE

ALOBIELLA HUSNOTI (Gottsche) Spruce, On Cepalozia 30. 1882. On soil. El Yunque, 1902, *Evans, 56* (Y.); El Duque, Sierra de Naguabo, 1914, *Shafer 3720* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7727, 7728* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 393, 402a, 410* (P.); El Yunque, 1937, *Pagán 516a* (P.).

DISTRIBUTION: Peru, Guadeloupe, Dominica, Martinique.

CEPHALOZIA FORFICATA Spruce, on Cephalozia 46. 1882. At base of tree fern and on rotten logs. Mte. Torito, Canóvanas, 1937, *Pagán 275, 295* (P.); Santa Rosa near Los Picachos, Jayuya, 1937, *Pagán 309* (P.).

DISTRIBUTION: Peru.

CEPHALOZIA SANDVICENSIS (Mont.) Spruce, On Cephalozia 46. 1882. On trees and on logs. El Yunque, 1900, *Evans 36* (Y.); El Yunque, 1902, *Evans 108, 135, 181* (Y.); east slope of the Luquillo Mts., 1900, *Heller 4652, 4658* (Y.); Bo. de Maizales, Sierra de Naguabo, 1914, *N. L. Britton & Hess 2272* (Y.); Río Prieto and adjacent hills, Sierra de Naguabo, 1914, *Shafer 3701* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7734* (Y.).

DISTRIBUTION: Hawaii, Mexico, Cuba, Trinidad, Guadeloupe.

ODONTOSCHISMA DENUDATUM (Mart.) Dumort., Recueil d'Obs. sur les Jung. 19. 1835. On rotten logs, more rarely on shaded banks. North side of the Luquillo Mts., 1899, *Heller 1140, 1148, 1151* (Y.); El Yunque, 1900, *Evans 57* (Y.); Mt. Morales, Utuado, 1906, *Howe 1090* (Y., N.); Maricao to Mte. Alegrillo, 1913, *E. G. Britton 2656* (Y., N.); Maricao, 1937, *Pagán 205* (P.); El Yunque, 1937, *Pagán 479* (P.).

DISTRIBUTION: Widely distributed in Europe, Asia, North and South America.

ODONTOSCHISMA PORTORICENSE (Hampe & Gottsche) Steph., Hedwigia **27**: 296. 1888. On bark. Without definite date, locality or number, *Schwanecke*, reported under the name *Sphagnoecetis* (F.).

DISTRIBUTION: Cuba.

ODONTOSCHISMA PROSTRATUM (Sw.) Trevis., Mem. r. Ist. Lomb. III. **4**: 419. 1877. On rotten logs and on soil. Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7740* (Y., N.); El Yunque, 1937, *Pagán 193* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 398* (P.); first collected by *Schwanecke* and reported under the name *Sphagnoecetis*.

DISTRIBUTION: Widely distributed from Massachusetts to Florida, tropical America.

ZOOPSIS ANTILLANA Steph., Bull. Herb. Boiss. **8**: 268. (Spec. Hep. **3**: 282). 1908. On clay. Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7722* (Y., N.).

DISTRIBUTION: Dominica.

ZOOPSIS MONODACTYLA Spruce, Trans. & Proc. Edinb. Bot. Soc. **15**: 391. 1885. On the ground and on rotten wood. La Juanita, near Las Marías, 1915, *E. G. Britton 3992* (Y., N.).

DISTRIBUTION: Brazil.

LEPIDOZIACEAE

BAZZANIA BIDENS (Lindenb. & Gottsche) Trevis., Mem. r. Ist. Lomb. III. **4**: 415. 1877. On bark of living tree. Without definite date or locality, *Schwanecke, Sintenis 37*. El Yunque, 1937, *Pagán 488, 494, 560* (P.).

DISTRIBUTION: French Guiana, Peru, Brazil, Dominica, Martinique, Guadeloupe.

BAZZANIA BREUTELIANA (Lindenb. & Gottsche) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. On trees and on logs. Without definite date or locality, *Sintenis 28*.

DISTRIBUTION: St. Kitts, Guadeloupe, Dominica.

BAZZANIA **cubensis** (Gottsche) comb. nov. *Mastigobryum cubense* Gottsche, in Steph. Hedwigia **24**: 3. *pl. 3, f. 1 & 2*. 1885. On living trees and on old stumps. Maricao, 1937, *Pagán 216a, 237, 251* (P.).

DISTRIBUTION: Cuba.

BAZZANIA **Eggersiana** (Steph.) comb. nov. *Mastigobryum Eggersianum* Steph., Spec. Hep. **3**: 468. 1908. On living trees and on logs. Maricao, 1937, *Pagán, 247* (P.).

DISTRIBUTION: Cuba.

BAZZANIA GRACILIS (Hampe & Gottsche) Steph., Hedwigia **27**: 279. 1888. On living tree and on roots of living palm. El Yunque, 1937, *Pagán 201, 489* (P.); without definite date, locality or number, *Schwanecke*, as *Mastigobryum*.

DISTRIBUTION: Known only from Puerto Rico.

BAZZANIA PORTORICENSIS (Hampe & Gottsche) Steph., Hedwigia **27**: 279. 1888. On living tree. El Yunque, 1937, *Pagán 142, 189* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 291* (P.); Cerro de Punta, Jayuya, 1937, *Pagán 366* (P.); without definite date, locality or number, *Schwanecke*, as *Mastigobryum; Sintenis 87, 123.*

DISTRIBUTION: Mexico, Brazil, Costa Rica, West Indies.

BAZZANIA **quadricrenata** (Gottsche) comb. nov. *Mastigobryum quadricrenatum* Gottsche in Hedwigia **25**: 206. *pl. 1, f. 1–4.* 1886. On living tree. Mte. Torito, Canóvanas, 1937, *Pagán 283* (P.).

DISTRIBUTION: Brazil, Venezuela, Guadeloupe.

BAZZANIA SCHWANECKEANA (Hampe. & Gottsche) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. On living trees and on logs. Matrullas, Orocovis, 1936, *Pagán 22, 23* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 274* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 348* (P.); without definite date, locality or number, *Schwanecke*, distributed in G. R. Hep. Eur. 608, as *Mastigobryum;* without definite date or locality, *Sintenis 12.*

DISTRIBUTION: Martinique, Guadeloupe, Dominica.

BAZZANIA STOLONIFERA (Sw.) Trevis., Mem. r. Ist. Lomb. III. **4**: 415. 1877. Without definite date, locality or number, *Schwanecke*, as *Mastigobryum*.

DISTRIBUTION: Jamaica.

BAZZANIA VARIABILIS (Hampe. & Gottsche) Steph., Hedwigia **27**: 279. 1888. Without definite date, locality or number, *Schwanecke*, as *Mastigobryum*.

DISTRIBUTION: Guadeloupe, Martinique.

BAZZANIA VINCENTIANA (Lehm. & Lindenb.) Trevis., Mem. r. Ist. Lomb. III. **4**: 414. 1877. On living trees. El Yunque, 1902, *Evans 110* (Y.); Sierra de Luquillo, 1912, *Bro. Hioram 403* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 382a* (P.); El Yunque, 1937, *Pagán 539a* (P.); without definite date or locality, *Sintenis 16.*

DISTRIBUTION: Mexico, Brazil, Venezuela, Guiana, Cuba, St. Kitts, St. Vincent, Dominica, Guadeloupe, Martinique.

BAZZANIA WRIGHTII (Gottsche) Steph., Hedwigia **27**: 279. 1888.

Sierra de Luquillo, 1885, *Sintenis II-33* (N.); Adjuntas, 1886, *Sintenis II-92* (N.).

DISTRIBUTION: Cuba.

LEPIDOZIA CAPILLARIS (Sw.) Lindenb., G.L.N. Syn. Hep. 212. 1845. On bark and on soil. East slope of the Luquillo Mts., 1900, *Heller 4482, 4638* (Y.); El Yunque, 1902, *Evans 112* (Y.); Adjuntas-Jayuya Road, 1937, *Pagán 136b* (P.); El Yunque, 1937, *Pagán 478, 537, 565* (P.).

DISTRIBUTION: Jamaica.

LEPIDOZIA COMMUTATA Steph., Hedwigia **27**: 293. 1888. On living trees. El Yunque, 1900, *Evans 18* (Y.); El Yunque, 1902, *Evans 88* (Y.); Sierra de Luquillo, 1912, *Bro. Hioram 396* (Y.); Mte. El Duque, Sierra de Naguabo, 1914, *Shafer 3066, 3725b* (Y.); Sierra de Naguabo, 1914, *Johnston & Stevenson 1554 p.p., 1555 p.p.* (Y.); El Yunque, 1937, *Pagán 551* (P.).

DISTRIBUTION: British Guiana, West Indies.

MICROPTERYGIUM EXALATUM Steph., Spec. Hep. **3**: 547. 1909. On stunted trees and on decayed wood. El Yunque, 1900, *Evans 50* (Y.); El Yunque, 1902, *Evans 53a* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 372* (P.).

DISTRIBUTION: Dominica.

MICROPTERYGIUM PORTORICENSE Steph., Hedwigia **27**: 294. *pl. 13, f. 29 & 30.* 1888. On logs. El Yunque, 1900, *Evans 9* (Y.); El Yunque, 1902, *Evans 53, 115* (Y.); Río Icaco and adjacent hills, Sierra de Naguabo, 1914, *Shafer 3751, 3775 p.p., 3776 p.p.* (Y.); El Yunque, 1937, *Pagán 166, 384, 516* (P.); without definite date, locality or number, *Schwanecke*, as *M. cymbifolium* N.L.G.

DISTRIBUTION: Dominica.

TELARANEA NEMATODES (Gottsche) M. A. Howe, Bull. Torr. Bot. Club **29**: 284. 1902. On moist soil. El Yunque, 1902, *Evans 16* (Y.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2176* (Y.); Laguna Tortuguero, 1924, *Britton & Britton 7958* (Y.); Bo. Cialitos, Jayuya, 1937, *Pagán 334* (P.); Cerro de Punta, Jayuya, 1937, *Pagán 356* (P.).

DISTRIBUTION: Southern Africa, Southern United States, South America, Cuba, Bermuda.

CALYPOGEIACEAE

CALYPOGEIA MIQUELII Mont., G.L.N. Syn. Hep. 200. 1845. Without definite date, locality or number, *Schwanecke.*

DISTRIBUTION: Tropical America.

CALYPOGEIA PORTORICENSIS (Steph.) Evans, THE BRYOLOGIST **10**: 30. 1907. On rotten logs in moist forest. El Yunque, 1902, *Evans 154* (Y.); Bo. de Maizales, Sierra de Naguabo, 1914, *Britton & Cowell 3101, 3102* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton &*

S. Brown 5469 (Y.); Indiera Fría, near Maricao, 1915, *N. L. Britton, J. F. Cowell & S. Brown 4404* (Y.); mountain between Guayama and Cayey, 1922, *Britton, Britton & M. S. Brown 6585* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 101* (P.); El Yunque, 1937, *Pagán 158* (P.); without definite date or locality, *Sintenis 58*.

DISTRIBUTION: Jamaica, St. Vincent, Dominica.

CALYPOGEIA SULLIVANTII Aust., Hep. Bor.-Amer. 74b. 1873. On wet banks and on rocks. Vicinity of Fajardo, 1899, *Heller 997a* (Y.); El Yunque, 1902, *Evans 114* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 531* (Y., N.); La Juanita, near Las Marías, 1915, *E. G. Britton 3981* (Y.).

DISTRIBUTION: Alabama, New Jersey, Massachusetts, Rhode Island, Connecticut, North Carolina, Arkansas.

CALYPOGEIA TRICHOMANIS (L.) Corda, Opiz Beitr. zur Naturg. 653. 1829. On logs and on wet soil. Without definite date, locality or number, *Schwanecke*.

DISTRIBUTION: Europe, Siberia, Japan, North America.

PTILIDIACEAE

HERBERTA JUNIPERINA[4] (Sw.) Trevis., Mem. r. Ist. Lomb. III. **4**: 397. 1877. On living trees and on rocks. Sierra de Luquillo, 1885, *Sintenis 30* (Y.); El Yunque, 1902, *Evans 52* (Y.); Mte. Torrecilla, 1911, *Bro. Hioram 2* (Y.); Río de Maricao, 1913, *E. G. Britton 2500* (Y.); Río Icaco and adjacent hills, Sierra de Naguabo, 1914, *Shafer 3062, 3712a, 3733, 3748* (Y.); El Yunque, 1937, *Pagán 472, 475, 538* (P.).

DISTRIBUTION: Jamaica, Dominica, St. Vincent.

ISOTACHIS ERYTHRORHIZA (Lehm. & Lindenb.) Steph., Spec. Hep. **3**: 664. 1909. On rocks. Adjuntas-Jayuya Road, 1937, *Pagán 134, 135, 136* (P.); El Yunque, 1937, *Pagán 547* (P.).

DISTRIBUTION: Dominica, Guadeloupe, Martinique.

TRICHOCOLEA FLACCIDA Spruce, Trans. & Proc. Edinb. Bot. Soc. **15**: 349. 1885. On old logs. Without definite date or locality, *Sintenis 86, 95*, under the name of *Leiomitra*.

DISTRIBUTION: Peru, Dominica.

TRICHOCOLEA TOMENTOSA (Sw.) Gottsche, in G. & R. Hep. Eur. exsicc. *No. 272*. On living trees. Mte. Torito, Canóvanas, 1937, *Pagán 265* (P.); Santa Rosa near Los Picachos, Jayuya, 1937, *Pagán 332* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 434a* (P.); El Yunque,

[4] Two other species of *Herberta* under the name of *Schisma angustifolium* Steph. and *S. lacerifolium* Steph. have been reported from the Island by Stephani in his Spec. Hep. vol. 4, pages 17 and 10 respectively. The writer has examined material of *S. lacerifolium* from the Farlow Herbarium and he would refer this to *Herberta juniperina* (Sw.) Trevis. No material of *S. angustifolium* has been available. Both species are excluded from the list.

1937, *Pagán 512, 528, 583* (P.); without definite date or locality, *Schwanecke*, as *T. tomentalla* β.

DISTRIBUTION: Ecuador, Jamaica, St. Vincent, Dominica.

SCAPANIACEAE

SCAPANIA PORTORICENSIS Hampe. & Gottsche, Linnaea **25**: 342. 1852. On trees and on rocks. Mte. El Duque, Sierra de Naguabo, 1914, *Johnston & Stevenson 1554, 1619* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 382* (P.); El Yunque, 1937, *Pagán 519* (P.); without definite date or locality, *Sintenis 29*, First collected by *Schwanecke*.

DISTRIBUTION: Colombia, Ecuador, Brazil, Bolivia, Cuba, Jamaica.

RADULACEAE

RADULA CALDANA Ågnstr., Ofversigt. af Kongl. Vetensk.-Akad. Forhandl. **1876**[7]: 81. 1876. On rotten log. Maricao, 1937, *R. H. Moore 8* (P.).

DISTRIBUTION: Brazil.

RADULA DOMINICENSIS Steph., Spec. Hep. **6**: 507. 1924. On bark. El Yunque. 1902, *Evans 105* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 294* (P.); El Yunque, 1937, *Pagán 555* (P.).

DISTRIBUTION: Dominica.

RADULA EVANSII Castle, Ann. Bryologici **11**: 37. 1938. On the upper surface of the leaves of palms. Without definite date, locality or number, *Sintenis*, as *R. Grevilleana* Tayl.

DISTRIBUTION: Dominica.

RADULA FLACCIDA Lindenb. & Gottsche, G.L.N. Syn. Hep. 726. 1847. Scattered or in depressed mats, closely appressed to the upper surface of the living leaves of trees, shrubs and herbs. Vicinity of Santurce, 1899, *Heller 462* (Y.); Mayagüez, 1900, *Heller, without number* (Y.); vicinity of Cayey, 1900, *Evans, without number* (Y.); El Yunque, 1902, *Evans 6* (Y.); near Utuado, 1906, *W. M. Wheeler 992, 1238* (N.); without definite locality, *1916, H. H. Whetzel*, as *R. Grevilleana* Tayl. in Herb. A. le Roy Andrews; without definite date or locality, *Sintenis 135*.

DISTRIBUTION: Dade County, Florida, West Indies, Mexico, Central America, northern South America, St. Thomas and Principe Islands, Central Continental Africa, Comora Islands.

RADULA KEGELII Gottsche, Hedwigia **23**: 152. 1884. Without definite date or locality, *Sintenis 140*.

DISTRIBUTION: Brazil, Surinam.

RADULA KORTHALSII Steph., Hedwigia **23**: 133. 1884. Adjuntas, 1886, *Sintenis 55* (Y.); Bo. de Maizales, Sierra de Naguabo, 1914, *N. L. Britton & J. F. Cowell 3104* (Y.); Sierra de Naguabo, summit of Loma la Mina, 1914, *Shafer 3363b* (Y.); Valley of Toro Negro, north of Villalba, 1923, *Britton, Britton & Horne 7488* (Y.).

DISTRIBUTION: Tropical America.

RADULA LAXIRAMEA Steph., Spec. Hep. **4**: 178. 1910. On living trees. Bo. Guaraguao, Ponce, 1936, *Pagán 16, 462 p.p., 463* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 280* (P.).

DISTRIBUTION: Panama, Guatemala.

RADULA PALLENS (Sw.) Nees, G.L.N. Syn. Hep. 256. 1845. On living trees. Adjuntas, 1885, *Sintenis 55;* Mte. Mesas, Mayagüez, 1913, *N. L. Britton & W. E. Hess 2731* (Y.); Río Prieto and adjacent hills, Sierra de Naguabo, 1915, *Shafer 3287a* (Y.); vicinity of Ala de la Piedra, above Villalba, 1922, *N. L. Britton & F. S. Earle 6118* (Y.); mountain between Guayama and Cayey, 1922, *Britton, Britton & M. S. Brown 6611* (Y.); Valley of Toro Negro, north of Villalba, 1923, *Britton, Britton & Horne 7488* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 104* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 264a, 268, 269* (P.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 327* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 440* (P.); Bo. Guaraguao, Ponce, 1937, *Pagán 462 p.p.* (P.).

DISTRIBUTION: Widely distributed in tropical America, especially in the West Indies.

RADULA PORTORICENSIS Steph., Hedwigia **27**: 298. 1888. On tree trunks. Without definite date or locality, *Sintenis 75, the type.*

DISTRIBUTION: Jamaica, Santo Domingo, Guadeloupe, St. Vincent.

RADULA RECUBANS Tayl., Lond. Jour. Bot. **5**: 376. 1846. Utuado, 1887, *Sintenis H-129* (N.).

DISTRIBUTION: Brazil, British Guiana, Venezuela.

RADULA SUBSIMPLEX Steph., Hedwigia **23**: 130. 1884. On trees. Bertero in Herb. Jack; Konstanz.

DISTRIBUTION: Guadeloupe, Dominica.

RADULA SURINAMENSIS Steph., Hedwigia **23**: 136. 1884. Near Adjuntas, 1886, *Sintenis H-77* (Y.).

DISTRIBUTION: Tropical and subtropical America.

RADULA TECTILOBA Steph., Hedwigia **27**: 298. *pl. 13, f. 39.* 1888. On bark. Without definite date or locality, *Sintenis 65, the type* (F.); Hato Arriba, near Arecibo, 1914, *E. G. Britton 2024c* (Y.).

DISTRIBUTION: Cuba, Dominica.

PORELLACEAE

PORELLA SWARTZIANA (Web.) Trevis., Mem. r. Ist. Lomb. III. **4**: 407. 1877. Under rocks. Barranquitas, 1885, *Sintenis 46* (Y.); Mte. Torrecilla, 1911, *Bro. Hioram 158* (Y.).

DISTRIBUTION: Louisiana, Mexico, Panama, West Indies.

LEJEUNEACEAE

ANOPLOLEJEUNEA CONFERTA (Meissn.) Evans, Bull. Torr. Bot. Club **35**: 175. *pl. 8, f. 9–23.* 1908. On trees. Without definite locality, *Sintenis 100.*

DISTRIBUTION: Jamaica, Trinidad, Mexico, Brazil, Venezuela, Colombia, Peru.

APHANOLEJEUNEA CRENATA Evans, Bull. Torr. Bot. Club **38**: 276. *pl. 12. f. 11–16.* 1911. On living leaves. El Yunque, 1900, *Evans 36 p.p.* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

APHANOLEJEUNEA EXIGUA Evans, Bull. Torr. Bot. Club **38**: 273. *pl. 12. f. 4–10.* 1911. On living leaves. El Yunque, 1900, *Evans 21 p.p.* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

APHANOLEJEUNEA SICAEFOLIA (Gottsche) Evans, Bull. Torr. Bot. Club **38**: 277. *pl. 12, f. 17–26.* 1911. On leaves and logs. Without definite date or locality, *Sintenis 4;* north slope of the Luquillo Mts., 1899, *Heller 4647 p.p.* (Y.); El Yunque, 1902, *Evans 13* (Y.).

DISTRIBUTION: Cuba, Trinidad, Florida.

APHANOLEJEUNEA SINTENISII Steph., Spec. Hep. **5**: 861. 1916. On living leaves. Without definite date or locality, *Sintenis 136,* as *Cololejeunea.*

DISTRIBUTION: Known only from Puerto Rico.

ARCHILEJEUNEA VIRIDISSIMA (Lindenb.) Evans, Bull. Torr. Bot Club **35**: 169. *pl. 8, f. 1–8.* 1908. On bark and on logs. El Yunque, 1902, *Evans 140* (Y.).

DISTRIBUTION: Venezuela, Bahama Islands, Jamaica.

BRACHIOLEJEUNEA BAHAMENSIS Evans, Bull. Torr. Bot. Club **35**: 383. *pl. 28, f. 1–14,* 1908. On bark, on limestone and on trees. Mona Island, 1914, *N. L. Britton, J. F. Cowell & W. E. Hess 1798* (Y.).

DISTRIBUTION: Cuba, Bahama Islands, Florida.

BRACHIOLEJEUNEA INSULARIS Evans, Bull. Torr. Bot. Club **35**: 159. *pl. 6, f. 1–22.* 1908. On trees, on logs and on rocks. Near Mayagüez, 1900, *Heller 4463a* (Y.); near Cayey, 1900, *Evans 97* (Y.), the type; Mt. Morales, Utuado, 1906, *Howe 465* (Y.); Cerro Ventana, Vieques, 1914, *Shafer 2989b* (Y.).

DISTRIBUTION: Cuba, Jamaica.

BRYOPTERIS FILICINA (Sw.) Nees, G.L.N. Syn. Hep. 284. 1845. Without definite date or locality, *Sintenis 1,* reported by Stephani.

DISTRIBUTION: Mexico, Brazil, Colombia, Costa Rica, Tahiti, Jamaica, Guadeloupe.

BRYOPTERIS FRUTICULOSA Tayl., Lond. Jour. Bot. **5**: 382. 1846. On trees and on rocks. Río de Maricao, 1913, *E. G. Britton 2491* (Y.); Maricao, 1937, *Pagán 221, 230, 250* (P.).

DISTRIBUTION: Widely distributed in tropical America.

CAUDALEJEUNEA LEHMANNIANA (Gottsche) Evans, Bull. Torr. Bot. Club **34**: 554. *pl. 33, f. 1–12.* 1908. On twigs and on living leaves. Santurce, 1899, *Heller 838* (Y.).

DISTRIBUTION: Florida, Mexico, Brazil, Costa Rica, Cuba, Bahama Islands.

CERATOLEJEUNEA BREVINERVIS (Spruce) Evans, Bull. Torr. Bot. Club **32**: 282. 1905. On bark, on rotten logs and on wet rocks. North slope of the Luquillo Mts., 1899, *Heller 1131 p.p., 4712 p.p.* (Y.); Río de Maricao, 1913, *E. G. Britton 2677* (Y.).

DISTRIBUTION: Jamaica, Guadeloupe, Dominica.

CERATOLEJEUNEA INTEGRIFOLIA Evans, Bull. Torr. Bot. Club **38**: 213. *pl. 9, f. 13–19.* 1911. On bark. Vicinity of Fajardo, 1913, *Shafer 1724* (Y.).

DISTRIBUTION: Florida, Bahama Islands, Cuba.

CERATOLEJEUNEA PATENTISSIMA (Hampe. & Gottsche) Evans, Bull. Torr. Bot. Club **32**: 286. *pl. 20, f. 19–26.* 1905. Without definite date, locality or number, *Schwanecke.*

DISTRIBUTION: Cuba.

CERATOLEJEUNEA PORTORICENSIS (Hampe. & Gottsche) Evans, Bull. Torr. Bot. Club **34**: 15. *pl. 2, f. 13–22.* 1907. On twigs. Without definite date or locality, *Schwanecke 126.*

DISTRIBUTION: Reported by Spruce from either Dominica or St. Vincent.

CERATOLEJEUNEA SCHWANECKEI Steph., Hedwigia **34**: 237. 1895. On bark of trees or on logs, rarely on rocks or on living leaves. Without definite date, locality or number, *Schwanecke,* listed as *Lejeunea ceratantha* N. & M.; El Yunque, 1902, *Evans 26, 32, 71, 81, 118, 146, 147, 159, 189* (Y.); north slope of the Luquillo Mts., 1899, *Heller 5* (Y.); Mt. Morales, Utuado, 1906, *Howe 1107, 1108* (Y.); Mte. El Duque, Sierra de Naguabo, 1914, *Shafer 3072* (Y.); Río Prieto and adjacent hills, Sierra de Naguabo, *Shafer 3706* (Y.); mountain between Guayama and Cayey, 1922, *Britton, Britton & M. S. Brown 6598, 6607, 6608* (Y.); Cerro de Las Piñas, near Las Cruces, 1922, *N. L. Britton, J. Matz & C. E. Chardón 6910* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7732, 7738, 7743* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 77 p.p.* (P.); Santa Rosa near Los Picachos, Jayuya, 1937, *Pagán 317 p.p.* (P.); El Yunque, 1937, *Pagán 160* (P.).

DISTRIBUTION: Guadeloupe.

CERATOLEJEUNEA SINTENISII Steph., Hedwigia **34**: 237. 1895. On living trees. Near Yabucoa, without date, *Sintenis 125;* north slope of the Luquillo Mts., 1900, *Heller 4722, 4723 4724,* (Y.); Mte. Guilarte, Adjuntas, 1937, *Pagán 434a* (P.).

DISTRIBUTION: Martinique.

CERATOLEJEUNEA SPINOSA (Gottsche) Steph., Hedwigia **34**: 238. 1895. On the bark of trees or on prostrate logs, more rarely on living leaves. El Yunque, 1900, *Evans 42* (Y.); El Yunque, 1902, *Evans 61, 74, 97, 101, 167* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7735, 7736* (Y.); El Yunque, 1937, *Pagán 533* (P.); collected by *Sintenis 34, 35.*

DISTRIBUTION: St. Kitts, Guadeloupe, Dominica, Martinique, St. Vincent.

CERATOLEJEUNEA VALIDA Evans, Bull. Torr. Bot. Club **32**: 280. *pl. 19, f. 12–20.* 1905. On bushes. El Yunque, 1902, *Evans 91* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

CERATOLEJEUNEA VARIABILIS (Lindenb.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. I[3]: 125. 1893. On bark of trees, on rotten logs, on living leaves and on rocks. Without definite dates, localities or numbers, *Schwanecke, Sintenis;* vicinity of Utuado, 1906, *Howe, Britton & Cowell 869* (Y.).

DISTRIBUTION: St. Kitts, Dominica, Martinique, St. Vincent, Brazil.

CHEILOLEJEUNEA DECIDUA (Spruce) Evans, Bull. Torr. Bot. Club **32**: 188. 1905. On a log. El Yunque, 1902, *Evans 161* (Y.).

DISTRIBUTION: Florida, Cuba, Brazil.

CHEILOLEJEUNEA JAMAICENSIS Steph., Hedwigia **34**: 241. 1895. On living trees. Cerro de Punta, Jayuya, 1937, *Pagán 357* (P.).

DISTRIBUTION: Jamaica.

COLOLEJEUNEA DIAPHANA Evans, Bull. Torr. Bot. Club **32**: 184. *pl. 5, f. 9–14.* 1905. On leaves of trees. Three miles east of Santurce, 1899, *Heller 464* (Y.).[5]

DISTRIBUTION: Florida.

COLOLEJEUNEA MYRIOCARPA (Nees & Mont.) Evans, Bull. Torr. Bot. Club **38**: 256. 1911. On bark of trees and on stones. Vicinity of Cayey, 1900, *Evans 81, 101* (Y.); Desecheo Island, 1914, *N. L. Britton, J. F. Cowell & W. E. Hess 1610* (Y.).

DISTRIBUTION: Mexico, Cuba, Jamaica, St. John, St. Vincent.

COLURA TORTIFOLIA (Mont.) Steph., Spec. Hep. **5**: 934. 1916. Thirteen kilometers north of Cayey on the Military Road, 1901, *Underwood & Griggs 277 p.p.* (Y.).

DISTRIBUTION: French Guiana, Ecuador, Cuba.

CYCLOLEJEUNEA ACCEDENS (Gottsche) Evans, Bull. Torr. Bot. Club **31**: 201. *pl. 9, f. 17–23.* 1904. On living leaves. El Yunque, 1900, *Evans 21 p.p.* (Y.); Sierra de Naguabo, 1914, *Shafer 2249* (Y.); also collected by *Schwanecke.*

DISTRIBUTION: Peru, Bolivia, St. Kitts, Dominica, St. Vincent.

[5] The material upon which this record is based is too poorly developed for positive determination. *See* Evans, Bull. Torr. Bot. Club **38**: 259. 1911.

CYCLOLEJEUNEA ANGULISTIPA (Steph.) Evans, Bull. Torr. Bot. Club **31**: 203. *pl. 10, f. 1–17.* 1904. On bark of trees and on logs. North slope of the Luquillo Mts., 1899, *Heller 4716, 4738, 4743 p.p.* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, J. F. Cowell & S. Brown 5551* (Y.).

DISTRIBUTION: Jamaica, Martinique.

CYCLOLEJEUNEA CHITONIA (Tayl.) Evans, Bull. Torr. Bot. Club **31**: 194. *pl. 8, f. 16–23.* 1904. On bark of trees, more rarely on logs. North slope of the Luquillo Mts., 1899, *Heller 1133, 4736 p.p.* (Y.); El Yunque, 1902, *Evans 28, 75, 82, 160* (Y.); Sierra de Naguabo, 1914, *N. L. Britton & J. F. Cowell 3103* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7731* (Y.).

DISTRIBUTION: British Guiana, St. Vincent, Martinique, Jamaica, Grenada.

CYCLOLEJEUNEA CONVEXISTIPA (Lehm. & Lindenb.) Evans, Bull. Torr. Bot. Club **31**: 198. *pl. 9, f. 1–16.* 1904. On living leaves, on the bark of trees and on rotten logs. North slope of the Luquillo Mts., 1899, *Heller 1147* (Y.); east of Santurce, 1900, *Heller 4326, 4329* (Y.); El Yunque, 1902, *Evans 7, 12, 18, 19, 22, 31, 133, 142, 162, 193* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 1460* (Y.); Río de Maricao, 1913, *Britton & Marble 2680* (Y.); Maricao to Mte. Alegrillo, 1913, *Britton & Marble 2627* (Y.); Sierra de Naguabo, 1914, *Shafer 3710* (Y.); Mte. El Duque, Sierra de Naguabo, 1914, *Johnston & Stevenson 1626* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5459* (Y.); Río de Maricao, 1915, *N. L. Britton & J. F. Cowell 4242* (Y.); mountain between Guayama and Cayey, *1922, Britton, Britton & M. S. Brown 6605* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 273 p.p.* (P.); El Yunque, 1937, *Pagán 533c* (P.); first collected by *Schwanecke*, and later by *Sintenis 4, 97.*

DISTRIBUTION: Widely distributed in the American Tropics.

CYRTOLEJEUNEA HOLOSTIPA (Spruce) Evans, Bull. Torr. Bot. Club **30**: 553. *pl. 21, f. 10–23.* 1903. On bark of trees, rarely on living leaves. El Yunque, 1902, *Evans 32 p.p., 46 p.p.* (Y.).

DISTRIBUTION: Brazil, Venezuela, Cuba, St. Vincent.

CYSTOLEJEUNEA LINEATA (Lehm. & Lindenb.) Evans, Bull. Torr. Bot. Club **33**: 17. *pl. 3. f. 1–19.* 1906. On trees. Without definite dates, localities or numbers, *Schwanecke, Sintenis;* El Yunque, 1900, *Evans 38b* (Y.); El Yunque, 1902, *Evans 62, 99* (Y.); Sierra de Luquillo, 1912, *Bro. Hioram 397, 418* (Y.); Mte. El Duque, Sierra de Naguabo, 1914, *Johnston & Stevenson 1555* (Y.); Sierra de Naguabo, 1914, *Shafer 3071b* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7722, 7749* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 377 p.p.* (P.); El Yunque, 1937, *Pagán 506, 520* (P.).

DISTRIBUTION: St. Kitts, Guadeloupe, St. Vincent, Dominica.

DIPLASIOLEJEUNEA BRACHYCLADA Evans, Bull. Torr. Bot. Club **39**: 216. *pl. 16, f. 10–18.* 1912. On the bark of trees. El Yunque,

1902, *Evans 24, 127 p.p.* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5452* (Y.).

DISTRIBUTION: Jamaica.

DIPLASIOLEJEUNEA PELLUCIDA (Meissn.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 121. 1893. On living trees. Without definite date, locality or number, *Schwanecke;* near Adjuntas, 1886, *Sintenis 4441* (Y.); El Yunque, 1902, *Evans 10, 120 p.p., 127 p.p.* (Y.); Loma la Mina, Sierra de Naguabo, 1914, *Shafer 3261* (Y.); Candelaria, near Bayamón, 1914, *E. G. Britton 1520* (Y.).

DISTRIBUTION: Cuba, Jamaica, Costa Rica, French Guiana, Brazil, East Indies, New Caledonia.

DIPLASIOLEJEUNEA PELLUCIDA var. MALLEIFORMIS Evans, Bull. Torr. Bot. Club **39**: 215: *f. 1.* 1912. On leaves, rarely on bark. El Yunque, 1902, *Evans 10, 120 p.p., 127 p.p.* (Y.).

DISTRIBUTION: Jamaica, Dominica, St. Vincent.

DIPLASIOLEJEUNEA RUDOLPHIANA Steph., Hedwigia **35**: 79. 1896. On the bark of trees. Vicinity of Cayey, 1900, *Evans 102* (Y.); vicinity of Martín Peña, Río Piedras, 1923, *Britton & Britton 7100* (Y.).

DISTRIBUTION: Florida, Bahama Islands, Cuba, Haiti, Jamaica, Dutch Guiana, Brazil.

DIPLASIOLEJEUNEA UNIDENTATA (Lehm. & Lindenb.) Schiffn., Bot. Jahrb. **23**: 583. 1897. On bark, rarely on leaves. El Yunque, 1902, *Evans 2, 120 p.p., 127 p.p., 145* (Y.).

DISTRIBUTION: Jamaica, Dominica, Martinique, St. Vincent.

DREPANOLEJEUNEA ARAUCARIAE Steph., Hedwigia **35**: 80. 1896. On living leaves. El Yunque, 1902, *Evans 36, 197* (Y.).

DISTRIBUTION: Brazil.

DREPANOLEJEUNEA BIDENS (Steph.) Evans, Bull. Torr. Bot. Club **30**: 29. *pl. 3. f. 9–17.* 1903. On rotten wood. North slope of the Luquillo Mts., 1899, *Heller 1139* (Y.); El Yunque, 1902, *Evans 4, 15, 196* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, J. F. Cowell & S. Brown 5678* (Y.).

DISTRIBUTION: Peru, North Carolina, Tennessee.

DREPANOLEJEUNEA BIOCELLATA Evans, Bull. Torr. Bot. Club **30**: 22. *pl. 1, f. 1–9.* 1903. On living leaves and on logs. El Yunque, 1900, *Evans 23* (Y.); El Yunque, 1902, *Evans 89 p.p.* (Y.); Río de Maricao, 1914, *N. L. Britton & J. F. Cowell 4256* (Y.).

DISTRIBUTION: Known only from Puerto Rico. *No. 23* is the type.

DREPANOLEJEUNEA BISPINULOSA Evans, Bull. Torr. Bot. Club **30**: 32. *pl. 4, f. 1–7.* 1903. On rotten wood. North slope of the Luquillo Mts., 1900, *Heller 4743 p.p.* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

DREPANOLEJEUNEA CRASSIRETIS Evans, Bull. Torr. Bot. Club **30**: 25. *pl. 2, f. 1–13.* 1903. On a log. El Yunque, 1902, *Evans 89 p.p.* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

DREPANOLEJEUNEA CRUCIANELLA (Tayl.) Evans, Bull. Torr. Bot. Club **30**: 33. *pl. 4, f. 8–17.* 1903. On living leaves. El Yunque, 1900, *Evans 42 p.p., 43 p.p.* (Y.).

DISTRIBUTION: British Guiana, Brazil.

DREPANOLEJEUNEA DISSITIFOLIA Evans, Bull. Torr. Bot. Club **30**: 28. *pl. 3, f. 1–8.* 1903. On living leaves. El Yunque, 1900, *Evans 23 p.p.* (Y.).

DISTRIBUTION: Known only from Brazil.

DREPANOLEJEUNEA INCHOATA (Meissn.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**[3]: 126. 1893. On living leaves. El Yunque, 1900, *Evans 13, 21b, 40, 41, 42* (Y.); El Yunque, 1902, *Evans 117* (Y.); El Yunque, 1937, *Pagán 533b, 534, 559a* (P.).

DISTRIBUTION: West Indies, Costa Rica and several other localities in tropical and subtropical America; first collected in Puerto Rico by *Schwanecke.*

DREPANOLEJEUNEA INFUNDIBULATA (Spruce) Evans, Bull. Torr. Bot. Club **30**: 35. *pl. 5, f. 1–11.* 1903. On living leaves. El Yunque, 1900, *Evans 21 p.p., 21a, 22, 23 p.p.* (Y.).

DISTRIBUTION: Andes.

DREPANOLEJEUNEA PINNATILOBA (Gottsche) Schiffn., Bot. Jahrb. **23**: 591. 1897. On shaded banks. Río de Maricao, 1913, *E. G. Britton 2508* (Y.).

DISTRIBUTION: Cuba.

DREPANOLEJEUNEA SUBULATA Steph., Hedwigia **35**: 83. 1896. On the bark of trees, mixed with other hepatics. North slope of the Luquillo Mts., 1899, *Heller 4737 p.p.* (Y.); Luquillo Mts., 1900, *Heller 4712* (Y.); Mt. Morales, Utuado, 1906, *Britton & Marble 1097 p.p.* (Y.); vicinity of Ala de la Piedra, above Villalba, 1923, *Britton, Britton & Horne 7498* (Y.); first collected by *Schwanecke.*

DISTRIBUTION: Known only from Puerto Rico.

EUOSMOLEJEUNEA CLAUSA (Nees & Mont.) Evans, THE BRYOLOGIST **11**: 69. 1908. On trees, rotten logs and on rocks. Three miles east of Santurce, 1899, *Heller 461* (Y.); north side of the Luquillo Mts., 1899, *Heller 4325, 4561a* (Y.); El Yunque, 1902, *Evans 1* (Y.); Mt. Morales, Utuado, 1906, *Howe 411* (Y.); between Coamo and Caguas, 1906, *Britton & Marble (without number)* (Y.); vicinity of Mayagüez, 1913, *Britton & Marble 534* (Y.); between Maricao and Mte. Alegrillo, 1913, *E. G. Britton 2637* (Y.); Río de Maricao, 1913, *E. G. Britton 2681* (Y.); Cerro Ventana, Vieques, 1914, *Shafer 2989c* (Y.); vicinity of Utuado, 1915, *E. G. Britton 5164* (Y.); La Juanita, near Las Marías,

1915, *E. G. Britton 3976* (Y.); La Chiquita, near Maricao, 1915, *Britton & Cowell 4293* (Y.); Indiera Fría, near Maricao, 1915, *Britton, Cowell & S. Brown 4432* (Y.); mountain between Guayama and Cayey, 1922, *Britton, Britton & Earle 6470* (Y.); Maricao, 1937, *Pagán 234, 253* (P.); Laguna San José, near Río Piedras, 1937, *Pagán 419, 420* (P.).

DISTRIBUTION: Widely distributed in tropical and subtropical America.

EUOSMOLEJEUNEA DURIUSCULA (Nees) Evans, Mem. Torr. Bot. Club **8**: 135. *pl. 18, f. 12–23.* 1902. On trees, and on logs; often growing with mosses and other hepatics. North slope of the Luquillo Mts., 1899, *Heller 4649, 4755* (Y.); Mt. Morales, Utuado, 1906, *Howe 1126* (Y.); between Arecibo and Utuado, 1906, *Britton & Cowell 377* (Y.); Río de Maricao, 1915, *Britton & Cowell 4255* (Y.); Cerro de Las Piñas, near Las Cruces, 1922, *N. L. Britton, J. Matz & C. E. Chardón 6912* (Y.); without definite date or locality, *Sintenis 52, 53.*

DISTRIBUTION: Southern United States, tropical America.

EUOSMOLEJEUNEA TRIFARIA (Nees) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 124. 1893. On bark of trees, on logs and on rocks. North slope of the Luquillo Mts., without date, *Heller 4719 p.p., 4721 p.p.* (Y.); El Yunque, 1902, *Evans 27, 33* (Y.); mountain between Guayama and Cayey, 1922, *Britton, Britton & Earle 6471* (Y.); Sierra de Yabucoa, 1922, *same collectors 6320* (Y.); Maricao, 1937, *Pagán 222* (P.); Mte. Guilarte, 1937, *Pagán 432* (P.); near Maricao, 1937, *R. H. Moore 17 p.p.* (P.); first collected on the Island by *Schwanecke.*

DISTRIBUTION: Widely distributed in tropical regions throughout the world.

HARPALEJEUNEA HETERODONTA Evans, Bull. Torr. Bot. Club **30**: 551. *pl. 21, f. 1–9.* 1903. On living leaves. El Yunque, 1900, *Evans 20 p.p., 160 p.p.* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

HARPALEJEUNEA SUBACUTA Evans, Bull. Torr. Bot. Club **30**: 547. *pl. 20, f. 1–11.* 1903. On bark of trees. North slope of the Luquillo Mts., 1899, *Heller 1141* (Y.), *the type;* Luquillo Mts., 1900, *Heller 4708, 4719 p.p., 4721 p.p., 4731a, 4733* (Y.); El Yunque, 1902, *Evans 3, 149* (Y.); Mt. Morales, Utuado, 1906, *Howe 1140* (Y.); originally collected by *Sintenis.*

DISTRIBUTION: Known only from Puerto Rico.

HARPALEJEUNEA UNCINATA Steph., Hedwigia **35**: 97. 1896. On bark of trees and on living leaves. North slope of the Luquillo Mts., 1900, *Heller 4763* (Y.); El Yunque, 1937, *Pagán 533a* (P.).

DISTRIBUTION: Cuba, Santo Domingo, Trinidad.

(To be continued)

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CONTENTS

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MICROCLIMATE, EVAPORATION STRESS, AND EPIPHYTIC MOSSES

J. E. POTZGER

It is a well recognized fact that vegetation is an expression of climate, and records of former vegetation are used extensively in translation of the climate which made it possible. It is, however, not always well recognized that the climate in its extensive aspect, macroclimate, is much modified by local or microclimatic factors, least of all has this microclimate been observed and studied intensively in connection with the more sensitive plant communities, such as epiphytic mosses.

True, it has long been recognized that there was a difference in the density of mosses on north and south sides of trunks of trees; it was also observed that corticolous mosses were less common or very nearly absent on trees in city parks and upland open woodlots, and until recently this absence was attributed to toxicity of gases emanating from chimneys and stacks in urban centers. Wilson (3) pointed out, for the same communities where the present study was carried on, that the difference in porosity of bark, with corresponding difference in moisture content, might well be the controlling factor of the presence or absence of mosses on trunks of trees. Young (4) made a special study of acidity and moisture content of bark from trees in the same locality. She found not only a difference in the hygroscopic potentiality in various kinds of bark but also discovered that bark from the north side of trees in the open woods on the Butler campus, where mosses are absent, had water content nearly comparable to that of bark from the south sides of trees in the forest on the Fort Harrison reservation, where mosses also were absent. She also found

that in ravines at Fort Harrison differences in amount of moisture, in bark from north and south sides of trees, were almost eliminated.

Wilson (3) pointed out that mosses are probably very sensitive indicators of plant climate and so record slight differences in moisture relationships which higher vegetation does not record. In regions typified by central Indiana, with moderate humidity and few fogs, apparently only optimum moisture conditions can supply sufficient water for the support of a fairly well developed corticolous moss vegetation.

Young (4) found, even in a year of abundant rainfall, that the highest percentage of moisture in bark was 18.5 per cent, while Billings and Drew (1), working in the Great Smoky mountains, found moisture in bare bark ranging from 25.9 to 124.5 percent. These workers reported a definite succession with decreasing moisture in the bark, from the base upward, from mesophytic to xerophytic moss communities, and they, too, interpret bark moisture as the controlling factor in distribution of corticolous bryophytic communities.

That such microclimatic controls induce very significant differences in moisture relationships has been reported by Darby (2). He found that differences in humidity induced by transpiration on the lower surface of leaves of the mango trees made it possible for certain fruit flies to endure the macroclimatic low humidity of the dry season in Mexico.

In order to gain a fuller understanding of the stresses in moisture relationships in these twice examined habitats, which vary only in exposure and slight topographic elevation, the present study had as its specific aim the investigation of differences in water loss during the growing season of the summer of 1938.

METHODS

Twenty-four Livingston bulb atmometers were placed at the two habitat types designated as upland and ravine. Similar areas of these habitat types were selected on the Butler University campus and in the beech-maple woods on the Fort Harrison reservation.

Two trees each were selected for upland and ravine, both for the Butler campus and the beech-maple woods at Fort Harrison. The atmometers were set into small wire baskets which had been fastened six feet up on the trunks, one atmometer each on north and south exposure. At one tree, in each habitat site at both areas, atmometers

TABLE 1. *Average water loss in cc. for each week*

Stations	North side		South side	
	Tree trunk	Tree base	Tree trunk	Tree base
"A"	162.9	—	163.6	—
"B"	159.6	74.1	188.0	116.2
"G"	107.0	101.7	109.0	96.0
"H"	125.2	—	137.2	—
"C"	124.3	46.7	116.5	44.3
"D"	126.9	—	143.1	—
"E"	70.3	40.3	61.9	47.2
"F"	53.9	—	50.3	—

TABLE 2. *Comparisons of water losses on north and south sides of trees, both trunks and bases, and differences between trunk and base*

Stations	Comparisons	Location	% Difference
"B"	s/n	trunk	17.8
"B"	s/n	base	56.0
"B"	trunk/base	north	115.4
"B"	trunk/base	south	61.7
"A"	s/n	trunk	2.9
"G"	s/n	trunk	19.9
"G"	n/s	base	5.9
"G"	trunk/base	north	5.2
"G"	trunk/base	south	13.7
"H"	s/n	trunk	9.5
"C"	n/s	trunk	6.5
"C"	n/s	base	5.5
"C"	trunk/base	north	166.0
"C"	trunk/base	south	163.0
"D"	s/n	trunk	10.2
"E"	n/s	trunk	13.5
"E"	s/n	base	17.2
"E"	trunk/base	north	74.5
"E"	trunk/base	south	31.0
"F"	n/s	trunk	7.3

TABLE 3. *Comparisons of upland stations B and G and ravine stations C and E*

Stations	Compared	Exposure	% Difference
"B"/"C"	trunk	north	28.0
"B"/"C"	trunk	south	61.5
"B"/"C"	base	north	58.5
"B"/"C"	base	south	162.6
"G"/"E"	trunk	north	52.1
"G"/"E"	trunk	south	76.2
"G"/"E"	base	north	152.3
"G"/"E"	base	south	131.8

TABLE 4. *Comparisons of Butler campus and Fort Harrison stations "B" and "G" upland, "C" and "E" ravine*

Stations	Compared	Exposure	% Difference
"B"/"G"	trunk	north	40.9
"B"/"G"	trunk	south	72.2
"G"/"B"	base	north	37.2
"B"/"G"	base	south	21.0
"C"/"E"	trunk	north	76.7
"C"/"E"	trunk	south	87.8
"C"/"E"	base	north	15.9
"C"/"E"	base	south	6.7

TABLE 5. *Abundance and distribution of mosses on trees*

Station	Tree trunk		Tree base		Tree
	North	South	North	South	
"A"	none	none	none	none	sugar maple
"B"	none	none	small patches below one foot		elm
"C"	none	none	few patches	same	elm
"D"	none	none	none	none	maple
"E"	abundant to 15 feet up	abundant not so high	abundant	abundant	ash
"F"	abundant to top	same	abundant	abundant	ash
"G"	none	none	small patches	small patches	hickory
"H"	scattered patches in crevices	same	scattered	less than on N	white oak

were also placed on north and south sides at the bases of the trees. Trees on the Butler campus were designated as stations "A" and "B" (upland), "C" and "D" (ravine) and at Fort Harrison "E" and "F" (ravine), "G" and "H" (upland). The observations continued for a period of 16 weeks from June 20 to October 13, 1938. The atmometers at stations "D" and "H" were not placed until June 27. Atmometers at station "A" were broken on September 9, and the one on the south side of station "D" was broken September 12.

Readings were made every Monday afternoon during the continuance of the experiment.

OBSERVATIONS

The upland stations consistently showed the highest water loss on the trunks of trees. Least loss was at the bases of trees. The loss on trees in the ravines at Butler campus was very similar to that on the trunks of trees occupying uplands at Fort Harrison (Table 1). As a whole, the atmometers on the south sides of trunks recorded the highest loss of water except at the ravine stations "C," both trunk and base, and "E," on the trunk, and the upland station "G," at the base (Table 2).

Atmometers on the trunks of trees recorded more loss in every instance than those at the bases. The greatest deviation between loss on trunk and at the base was at station "C" with a difference of 166% on the north side and 163% on the south side (Table 2). The least deviation was at the upland station "G" at Fort Harrison, where the difference between base and trunk was only 5.2% on the north and 13.7% on the south side.

Differences in loss between north and south exposure were, as a whole, small, the greatest was 56 per cent, at the base of station "B." A striking deviation from the usual higher loss for comparable stations on the Butler campus was at station "G," base, at Fort Harrison (Table 4).

When the average weekly losses are compared, one finds a close correlation between the two trees in the same habitat, except at the ravine stations "E" and "F" at Fort Harrison (Table 1).

Comparing the losses at ravine and upland stations, one finds some interesting differences (Table 3). On the Butler campus the greatest difference between two stations was recorded at stations "B"/"C," base, south exposure, where the upland station "B" had 162.6 per

cent more loss than the ravine station "C." At Fort Harrison the differences between the losses on trunks at upland and ravine stations are greater than at Butler, but here, too, the greatest deviations occur at the base, with station "G" showing 152.3 per cent more loss on the north side and 131.8 per cent on the south side than station "E." Comparing comparable stations at Butler and Fort Harrison, the biggest differences are, again, on the trunks (Table 4), climaxed by a difference of 87.8 per cent south exposure in the two ravine stations "C"/"E." This difference is nearly the same as the 76.2 per cent separating the upland and ravine stations "G" and "E" at Fort Harrison (Table 3). At no time was there more water loss at the base than on the trunk (Table 2), and only at station "G," base, north exposure, did evaporation at Fort Harrison exceed that of comparable stations at Butler.

DISCUSSION

This is probably the first paper presenting quantitative data on evaporation with relation to corticolous mosses. It will hardly be necessary to review again the various reasons advanced for the presence or absence of mosses on trunks of trees, especially in city parks and woodlots, but discussion will be limited to the present study on water losses. The results show that one cannot well generalize between north and south exposure with an assumed greater evaporation on the south side, especially when insolation is not the influencing factor. In this respect the present results support the findings by Young (4) that, in ravines at Fort Harrison, bark from north and south sides of trees showed little difference in moisture. Microclimate is much more complex and much more sensitively balanced than the macroclimate, so that it is difficult at times to isolate the controlling factor. The differences in evaporation induced by small topographic variations (ravine and upland), elevation above the surface, the consistent higher water losses at the stations in the open woodlot on the Butler campus, all show that epiphytic mosses are sensitive microclimate indicators.

Differences in evaporation due to exposure fluctuate greatly, ranging from n/s 13.5% at station "E," trunk, to s/n 56.0% at "B." As a whole, mere exposure does not seem to induce great variation. But even 10 or 19% consistently greater water loss of one station over another may become very important when a habitat condition is

sensitively balanced near a critical point, for then even an occasional extreme and not the average condition may become a limiting factor.

Differences between upland and ravine are, on the other hand, significantly great (Table 3), indicating that the ranges pass the critical point of moisture requirements and available supply for corticolous mosses. The same probability is indicated by the big differences between comparable stations at Butler and Fort Harrison (Table 4), and trunks and bases of trees at every station but "G" on the upland at Fort Harrison (Table 2). At this latter station the herbaceous and shrub layers are wanting, and air currents apparently sweep down the slope and across the ridge without any selective influence on base and trunk. Comparing these results with presence and abundance of mosses, we find that ravine stations "C" and "D" on the Butler campus are very similar to the upland stations "G" and "H" at Fort Harrison. (See Tables 1 and 5.)

There is apparently indicated a point of critical moisture relationships, influencing moss distribution, which is somewhere between the losses on upland and in ravine at Fort Harrison, tree trunks and bases, and ravines at Butler and at Fort Harrison. Such phenomena are no doubt best accentuated in a region like central Indiana where moisture is nearer the critical point than in regions where moisture in the atmosphere is always abundant, and where even trees in the open can support an abundant moss flora.

Air currents are apparently the most important single controlling factor in the humidity of the atmosphere in these forests. This is indicated by the difference between ravine and upland stations, and by the fact that north side of the base at station "B," where the crown cover of trees is open, but where the shrub layer is dense, had less water loss than the comparable location at station "G" where the crowns of trees formed a dense canopy but where shrub and herbaceous layers were wanting.

As already pointed out by Young (4), in undisturbed forests shrubs or small trees form a dense thicket at the edges, which retards or inhibits entirely the movement of wind in the forest. Even though station "D" on the Butler campus is located in a ravine it is no doubt influenced greatly by air currents which can sweep into the forest without obstruction from open fields to the east and west, and so the microclimate in this ravine is comparable to that on the upland at Fort Harrison. In fact, the average weekly water loss is greater at

the lowland station "D" (Butler) than at the upland station "G" (Fort Harrison) (Table 1).

The most striking differences are between upland and ravine stations, both on north and south exposures. On the tree trunk the south exposure always has significantly greater water loss than the north exposure (Table 3, "B"/"C" north 28% and south 61.5%, "G"/"E" north 52% and south 76%). The same is true for the two ravine stations "C" and "E" where with north exposure we find "C"/"E" 76.7% and with south exposure "C"/"E" 87.8%. This indicates that with respect to moisture the ravine habitat at Butler is comparable to the upland habitat at Fort Harrison.

Summer, 1938, had a very abundant rainfall. During the growing season there was hardly a week without one or several showers, so that excess accumulation of rainfall at times amounted to ten inches. One can readily picture the increased stresses in moisture relationships during years of scant precipitation.

It appears that epiphytic mosses on trees and on logs are sensitive indicators of microclimate and in regions of moderate precipitation, typified by central Indiana, are depressed in their distribution on trunks of trees with increased loss of water beyond the critical point, for differences of 115%, as at station "B," 166 and 163%, as at station "C" and 74%, as at station "E" (Table 2) are truly significant losses in any habitat where the extremes extend below the optimum condition favorable to growth. In the present study these differences do not represent extremes during a few weeks but average conditions.

Results of this atmometer study also support the argument of Young (4) that not absence of smoke in the ravines but rather greater humidity in the atmosphere there favored the development of more abundant and dense moss communities. Observations also suggest that moisture conditions which permit development of an abundant moss community also favor development of dense fern communities, especially of representatives of *Aspidium* and *Asplenium*.

SUMMARY

1. The paper presents results of an atmometer study on differences in water loss at the bases and six feet up on the trunks of trees. Compared were north and south exposures of trees on uplands and in ravines. Compared were also similar locations in the open woods on the Butler campus and a typical beech-maple woods on the Fort Harrison reservation.

2. North and south exposures *per se* showed as a whole comparatively small differences in water loss.

3. With the same exposure, differences in water loss between base and six feet up on the trunk were great. At the ravine station "C" it amounted to 166% and at the upland station "B" to 115%.

4. At comparable locations, big differences were found between upland and ravine stations, ranging from 28% to 162% greater losses at the upland stations.

5. As a whole, the stations in the Butler campus woods had significantly higher losses than comparable stations at Fort Harrison. In some cases this amounted to 87.8%.

6. Differences between north and south exposures at the bases of trees were small, especially at the stations in ravines.

7. Average weekly water loss at the ravine stations "C" and "D" on the Butler campus were similar to the losses at the upland stations "G" and "H" at Fort Harrison; the ravine stations had a slightly higher loss.

8. Differences in water loss between ravine and upland at Fort Harrison, ravine at Fort Harrison and ravine at Butler, base of trees and trunks of trees in all but the ravine stations at Fort Harrison were large.

9. Air currents apparently induce most of the differences in water loss at the various locations.

10. Trunks of trees on uplands and in ravines on the Butler campus apparently suffer greater loss of water than comparable locations at Fort Harrison because the borders of the woods at Butler are unprotected by shrubs and small trees, thus permitting the wind free movement through the woods.

11. Comparable water losses on trees supporting no moss vegetation in ravines on the Butler campus with those on upland at Fort Harrison also supporting no moss vegetation, indicates that moisture controls the establishment of moss communities on trees in this central Indiana region.

BUTLER UNIVERSITY,
INDIANAPOLIS, INDIANA

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THE MOSSES OF NORTH CAROLINA
V. DICRANACEAE TO CALYMPERACEAE

LEWIS E. ANDERSON

DICRANACEAE

DICRANELLA HETEROMALLA (Hedw.) Schimp. On moist soil in somewhat shaded places, in the mountains; often on decaying wood. No. MTS.: Ashe Co., *L. E. A.* 5857; Avery Co., *L. E. A.* 3974; Burke Co., *L. E. A.* 4090; Madison Co., *L. E. A.* 712; Mitchell Co., *Atkinson* 11343 (C); Watauga Co., *Small & Heller* '91 (NY). So. MTS.: Buncombe Co., *C. L. Pollard* '01 (NY); Haywood Co., *Thackston* 414; Jackson Co., *Watson* '28; Macon Co., *Sharp* '31 (V); Swain Co., *L. E. A.* 3324. No. PIEDMONT: Durham Co., *Blomquist* 2085; Granville Co., *L. E. A.* 2235; Person Co., *L. E. A.* 1107; Stokes Co., *Schallert* '21; Surry Co., *Blomquist* 6645. No. COAST.: Beaufort Co., *L. E. A.* 4634; Nash Co., *L. E. A.* 3641. So. COAST: Bladen Co., *L. E. A.* 3774; Hoke Co., *L. E. A.* 5101; Sampson Co., *L. E. A.* 6161; Scotland Co., *L. E. A.* 5096. Typical plants with falcate-secund leaves and capsules with the mouth strongly oblique are encountered commonly only in the mountains. In Piedmont and Coastal Plain, plants are smaller and less well developed with more erect capsules, approaching the following variety. Intergrading forms are common in the latter provinces but they are mostly referable to the species.

DICRANELLA HETEROMALLA var. ORTHOCARPA (Hedw.) Paris. (*D. Fitzgeraldi* R. & C.). Mostly in somewhat swampy places. No. PIEDMONT: Durham Co., *Blomquist* 6560; Forsyth Co., *Schallert* '22. No. COAST.: Johnston Co., *Mitchell* '36. So. COAST.: Brunswick Co., *Blomquist* 2083; Lee Co., *L. E. A.* 4753.

DICRANELLA RUFESCENS (Sm.) Schimp. Moist clayey soil, on banks in shaded areas. No. MTS.: Ashe Co., *L. E. A.* 5884. No. PIEDMONT: Durham Co., *Blomquist* 2087. Extends the known range southward from Virginia. The plants in Blomquist's collection are depauperate and scarcely typical, but they undoubtedly represent this species. It was hardly expected in the Piedmont, since the plant has northern affinities and reaches its southern limit here. Most species with similar affinities are strictly limited to the mountains.

DICRANELLA VARIA (Hedw.) Schimp. On soil, ditch banks, crevices of rocks, etc. No. MTS.: Watauga Co., *Atkinson* 11364. Specimen not examined but reported by Andrews as having been collected between Blowing Rock and Boone, September 7, 1901. Reported as frequent throughout its range, but the writer has neither collected it nor seen specimens of it from North Carolina. We are well within its range, however, and further collecting may show that it is more frequent.

RHABDOWEISIA DENTICULATA (Brid.) Bryol. Eur. (*R. crispata*

Kindb.) In rock crevices of ledges and cliffs in cool, somewhat moist places at high altitudes. No. MTS.: Avery Co., *Sharp* 36139; *L. E. A.* 3981; Burke Co., *L. E. A.* 4372; Mitchell Co., *L. E. A.* 4140; Watauga Co., *Atkinson* 10983 (C). So. MTS.: Haywood Co., *Grout* '07 (G); Macon Co., *Sharp* 34665 (T); Swain Co., *L. E. A.* 3333. Limited to the higher peaks, on rock exposures and ledges. Not collected south of North Carolina and Tennessee, but since it is common in our region it might be expected to occur farther south. Our plants are quite variable with respect to leaf serration, some having almost entire leaves, while others are markedly serrate. Many of our forms probably belong to the var. *americana* Culm.

DICHODONTIUM PELLUCIDUM (Hedw.) Schimp. (*D. flavescens* Lindb.) On rocky or gravelly soil along streams in cool, moist places. So. MTS.: Haywood Co., *L. E. A.* 742a; Swain Co., *L. E. A.* 814, 2800. Not heretofore reported for the state. Apparently rare and possibly limited to calcareous situations. The Swain County collections are from limestone around the edge of the outlet to an underground stream from which cool air is constantly issuing. This has given rise to the name "Blowing Springs." The pH of the water here is about 8.0. The Haywood County locality is on the side of Mt. Pisgah at an altitude of approximately 4500 feet but the pH of the soil was not taken. No limestone is known at that height, however, and the soil is thought to be quite acid. The plants may have grown in a local, neutral or slightly calcareous pocket. The plants from Mt. Pisgah have rather strongly serrate leaves and approach the var. *serrulatum* Schimp., but are scarcely as serrate as Grout's *Musci Perfecti* 110. Our plants are not as slender as those of Sharp's collections from Tennessee, and are scarcely referable to the var. *fagimontanum* (Brid.) Schimp.

ONCOPHORUS RAUEI (Aust.) Grout. On rocks, especially cliffs and large exposed outcrops at high altitudes. No. MTS.: Burke Co., *Sharp* '36 (NY), *L. E. A.* 4049. So. MTS.: Macon Co., *L. E. A.* 4189, 4176. No. PIEDMONT: Forsyth Co., *Schallert* '21, '11; Stokes Co., *Schallert* '21. Exceedingly variable macroscopically, especially in color, varying from almost black to light fulvous brown. The leaf structure is strikingly uniform, however, with the bistratose upper lamina and the numerous small, thick-walled cells just above the base.

ARCTOA FULVELLA (Dicks.) Bryol. Eur. (*Dicranum fulvellum* Dicks.) On rocks. So. MTS.: Transylvania Co., *Sharp* '33. The identity of this specimen may be open to some question since it is sterile, but the ovate, concave leaf base and narrow, longly excurrent costa comprising most of the upper part of the leaf, are almost identical to plants from Mt. Washington, collected by True. If correctly identified, this is the southernmost known station for the species, with no intervening stations known between here and the Adirondacks of New York.

DICRANUM BONJEANI DeNot. In situations similar to those preferred by *D. scoparium*. No. MTS.: Ashe Co., *L. E. A.* 5838. So. MTS.: Haywood Co., *L. E. A.* 748; Macon Co., *Sharp* '30 (V). No. PIEDMONT: Forsyth Co., *Schallert* '20. Not common. Forms of *D. scoparium* which approach this species are exceedingly common in the mountains, but in the majority of them the costa is strongly toothed on the back and the leaves are subulate. Only very rarely is a Piedmont or Coastal Plain plant encountered which resembles *D. Bonjeani*, and these forms have all been referred to *D. scoparium*.

DICRANUM CONDENSATUM Hedw. In the Coastal Plain on dry bare sandy soil; in the Piedmont on sandy or clayey soil in woods and not infrequently on humus. No. MTS.: Burke Co., *L. E. A.* 4389. No. PIEDMONT: Davie Co., *L. E. A.* 3581; Durham Co., *Blomquist* 2104; Franklin Co., *L. E. A.* 1; Iredell Co., *L. E. A.* 3551; Orange Co., *Blomquist* 7630; Stokes Co., *Schallert* '21; Surry Co., *Schallert* '24; Warren Co., *L. E. A.* 2106. So. PIEDMONT: Anson Co., *L. E. A.* 4972; Cleveland Co., *L. E. A.* 6104; Lincoln Co., *L. E. A.* 3511; Mecklenburg Co., *Gray* M1366 (G); Montgomery Co., *L. E. A.* 4846; Stanly Co., *J. K. Small* 33 (NY). No. COAST: Franklin Co., *E. Beaven* 337, 684; Johnston Co., *L. E. A.* 3615; Nash Co., *L. E. A.* 3635; Washington Co., *L. E. A.* 5971; Wilson Co., *L. E. A.* 3677. So. COAST: Bladen Co., *Blomquist* 7109; Brunswick Co., *Blomquist* 2089; Cumberland Co., *L. E. A.* 3762; Harnett Co., *L. E. A.* 6091; New Hanover Co., *L. E. A.* 3950; Pender Co., *L. E. A.* 3923; Richmond Co., *L. E. A.* 5052; Robeson Co., *L. E. A.* 3784; Sampson Co., *L. E. A.* 3808; Scotland Co., *L. E. A.* 5098.

Common in the Coastal Plain and Piedmont. In the Coastal Plain mostly a plant of the sand hills where, with various species of *Cladonia*, it forms the characteristic ground cover, growing on dry, barren sand around the base of scrub oaks. Plants of this habitat form very compact shallow mats and are typical of the species, with short, broad, acute leaves, somewhat papillose on the back above. Plants are occasionally found which resemble *D. spurium*, but there are no puzzling intergradations such as are found in other regions.

In the Piedmont what has been referred to *D. condensatum* grows in a variety of situations, ranging from sandy to clayey soils and in extreme cases on humus. A very common form occurs in our hardwood and pine forests of the Piedmont in situations which support *D. scoparium*, *Leucobryum glaucum*, etc. The plants are larger than those of the Coastal Plain, forming much larger and looser tufts, and the upper leaves of sterile plants are twisted about one another in a very characteristic manner. The leaves are long acuminate, usually markedly subulate and the leaf cells are scarcely if ever papillose, but

show the characteristic irregularly thickened arrangement. This form, evidently related to habitat, might be considered as a distinct variety were it not for the fact that every intergradation can be found between this and the plants of the Coastal Plain. They had best be considered as habitat variations. Many of these Piedmont plants, especially those in soils high in organic matter, can scarcely be distinguished from depauperate forms of *D. fuscescens*, with which they are sometimes found. It is interesting to note that the few specimens collected in the mountains closely resemble those of the Coastal Plain, as do plants from the higher elevations of the Piedmont, such as Table Rock Mt., Kings Mt., etc.

DICRANUM DRUMMONDII C. Muell. In boggy situations at high altitudes. No. MTS.: Avery Co., *Sharp* 36162 (T); Burke Co., *L. E. A.* 4064. Found for the first time in the state by Sharp in an upland bog near Pineola, extending its range southward from New Jersey. Later found by the writer within a few miles of Sharp's locality, in Linville Gorge, where it was growing in a small patch of *Sphagnum* under spray from a waterfall. Our specimens are easily distinguished from *D. Bergeri.* The specimens from Mt. Mitchell, which were named *D. Bergeri* by Holzinger, are merely robust forms of *D. scoparium.*

DICRANUM FLAGELLARE Hedw. Almost entirely on rotten wood, especially in swamps. No. MTS.: Burke Co., *L. E. A.* 3415; Madison Co., *L. E. A.* 2926; Yancey Co., *L. E. A.* 3441. So. MTS.: Buncombe Co., *L. E. A.* 832; Haywood Co., *L. E.A.* 257; Henderson Co., *Blomquist* 2091; Jackson Co., *L. E. A.* 484; Macon Co., *Sharp* '31 (V). No. PIEDMONT: Alexander Co., *L. E. A.* 3464; Davidson Co., *L. E. A.* 2409; Forsyth Co., *Schallert* '26; Guilford Co., *L. E. A.* 1301; Iredell Co., *L. E. A.* 3548; Stokes Co., *Schallert* '26; Surry Co., *Schallert* '20. So. PIEDMONT: Montgomery Co., *L. E. A.* 4833; Moore Co., *L. E. A.* 4811; Rowan Co., *L. E. A.* 2476; Rutherford Co., *L. E. A.* 2672. No. COAST.: Beaufort Co., *L. E. A.* 4603; Currituck Co., *L. E. A.* 38; Nash Co., *L. E. A.* 3657; Tyrrell Co., *L. E. A.* 6077; Washington Co., *L. E. A.* 5996; Wilson Co., *L. E. A.* 3674. So. COAST.: Anson Co., *L. E. A.* 4969; Moore Co., *Blomquist* 7242; Richmond Co., *L. E. A.* 5043; Robeson Co., *L. E. A.* 3806; Scotland Co., *L. E. A.* 5092. Well developed fruiting plants are not common. In coastal swamps small forms occur very abundantly on moist decaying logs. These produce numerous flagellae and have leaves shorter and broader than typical plants. Some might possibly be referred to the var. *minutissimum* Grout.

DICRANUM FULVUM Hook. On rocks. No. MTS.: Alleghany Co., *L. E. A.* 5810; Ashe Co., *L. E. A.* 5846; Burke Co., *L. E. A.* 4374; Mitchell Co., *Wetherby* (NY); Watauga Co., *Small* and *Heller* (NY);

Wilkes Co., *L. E. A.* 5909. So. MTS.: Buncombe Co., *Russell* 3 (NY); Haywood Co., *L. E. A.* 316; Jackson Co., *L. E. A.* 4254; Macon Co., *L. E. A.* 4187; Polk Co., *L. E. A.* 2728. No. PIEDMONT: Durham Co., *Blomquist* 2095; Orange Co., *Blomquist* 2094; Randolph Co., *L. E. A.* 2348. So. PIEDMONT: Rowan Co., *Small* '27 (C); Stanly Co., *Small* '92 (NY).

DICRANUM FULVUM var. VIRIDE (Sull. & Lesq.) Grout. (*D. viride* Lindb.) Bark of trees at high altitudes. So. MTS.: Buncombe Co., *Andrews* 251 (A); Macon Co., *Sharp* 34668 (T); Swain Co., *L. E. A.* 4331. Not uncommon in the Smoky Mts., but apparently rare or otherwise overlooked elsewhere. Along Bradley Fork in the Smokies it is especially common on the bark of buckeye trees.

DICRANUM FUSCESCENS Turn. On decaying wood and humus. No. MTS.: Alleghany Co., *L. E. A.* 5875; Avery Co., *Schallert* 57; Mitchell Co., *L. E. A.* 4147. So. MTS.: Haywood Co., *Blomquist* 2096; Jackson Co., *L. E. A.* 4238; Macon Co., *Sharp* 34664; Swain Co., *L. E. A.* 3305; Transylvania Co., *Grout* '07 (NY). No. PIEDMONT: Franklin Co., *E. Beaven* 315; Iredell Co., *L. E. A.* 3563. So. PIEDMONT: Lee Co., *L. E. A.* 4724, 4761; Rutherford Co., *L. E. A.* 2480. Common and easily recognized in the mountains, but depauperate forms are found in the Piedmont which are very puzzling. The leaves in the latter forms are not at all falcate-secund and the plants resemble the Piedmont form of *D. condensatum*. All the specimens of *D. fuscescens* from the Piedmont, however, have been collected on decaying wood, whereas *D. condensatum* is found only on soil or, at most, humus. Being a montane plant, it never assumes its typical development in the piedmont.

DICRANUM MONTANUM Hedw. On rocks and the bark of trees. No. MTS.: Alleghany Co., *L. E. A.* 5818; Avery Co., *Andrews* 251 (A). So. MTS.: Macon Co., *Sharp* '31 (V), '34 (T); Swain Co., *Sharp*, '37, 341064 (T). No. PIEDMONT: Forsyth Co., *Schallert* '20. Apparently not infrequent in the mountains, at least abundant locally. In a small cove near Sparta, the writer found seven or eight trees of which the trunks were almost completely covered with this species. Apparently a plant of rather high altitudes; it is strange that it should have been found by Dr. Schallert on tree trunks in the city of Winston-Salem, which although in the western Piedmont, does not provide montane conditions.

DICRANUM RUGOSUM (Hoffm.) Brid. (*D. undulatum* Sturm.) On humus in woods. No. PIEDMONT: Durham Co., *Blomquist* 2099, 7590, *L. E. A.* 6412; Forsyth Co., *Chapman* 1733; Franklin Co., *E. Beaven* 312; Guilford Co., *Mitchell* '35; Iredell Co., *L. E. A.* 3562. This northern species which ranges southward from Newfoundland and is here reported in North Carolina for the first time, has a very curious distribution. From our knowledge of other circumboreal plants which range southward, it would be expected to occur in the Appalachians,

but no collections are known from there. If it occurs at all in the mountains it must be rare, as it is a conspicuous plant and not easily overlooked. Several localities are known for this plant in the vicinity of Durham, where it is common locally, forming large tufts in loblolly pine and even hardwood forests.

DICRANUM SCOPARIUM Hedw. On soil, rocks, decaying wood and in various situations, although mostly shaded. No. MTS.: Alleghany Co., *L. E. A.* 1217; Ashe Co., *L. E. A.* 4588; Burke Co., *L. E. A.* 4305; Madison Co., *L. E. A.* 2988; Mitchell Co., *L. E. A.* 4112. So. MTS.: Buncombe Co., *L. E. A.* 830; Haywood Co., *Blomquist* '32; Henderson Co., *Blomquist* 2103; Jackson Co., *L. E. A.* 448; Macon Co., *Sharp* '31 (V); McDowell Co., *L. E. A.* 3048; Rutherford Co., *L. E. A.* 2660; Swain Co., *L. E. A.* 3315. NO. PIEDMONT: Alexander Co., *L. E. A.* 3449; Chatham Co., *Correll* '35; Davidson Co., *L. E. A.* 2424; Davie Co., *L. E. A.* 3577; Durham Co., *Blomquist* 2101; Forsyth Co., *Schallert* '21; Franklin Co., *E. Beaven* 357; Granville Co., *L. E. A.* 2171; Guilford Co., *L. E. A.* 1321; Iredell Co., *L. E. A.* 3541; Orange Co., *L. E. A.* 1074; Person Co., *L. E. A.* 1132; Randolph Co., *Correll* '35; Stokes Co., *Schallert* '21; Surry Co., *Blomquist* 6657; Vance Co., *L. E. A.* 2133; Wake Co., *L. E. A.* 3586; Warren Co., *L. E. A.* 2078. So. PIEDMONT: Cabarrus Co., *L. E. A.* 1014; Cleveland Co., *L. E. A.* 2624; Lincoln Co., *L. E. A.* 3515; Montgomery Co., *L. E. A.* 4828; Rowan Co., *L. E. A.* 2461; Stanly Co., *L. E. A.* 2481; Union Co., *L. E. A.* 2910. NO. COAST.: Johnston Co., *Mitchell* 18; Nash Co., *L. E. A.* 3636. So. COAST.: Anson Co., *L. E. A.* 4974; Bladen Co., *Blomquist* 2102; Cumberland Co., *L. E. A.* 3761; Lee Co., *L. E. A.* 4724; Richmond Co., *L. E. A.* 5026; Sampson Co., *L. E. A.* 3810. Exceedingly abundant and one of our most common mosses, but not as frequent in the Coastal Plain as in the other provinces. The majority of our specimens, especially those from the mountains, have straight leaves that are scarcely at all secund. From the large series of collections which have been made the extremely wide variation of nearly every character is apparent, but none of these are correlated with habitat or province. The same variations are present in wet or dry situations, in Mountains, Piedmont, or Coastal Plain.

DICRANUM SPURIUM Hedw. On dry open sandy soil, sometimes in woods. No. MTS.: Burke Co., *L. E. A.* 3103. No. PIEDMONT: Orange Co., *Blomquist* 7630; Surry Co., *Schallert* '20. Apparently rare and sporadic. The few specimens are typical and characteristic, having broad undulate leaves with numerous long papillae on the back, which are almost spines in some specimens.

DICRANODONTIUM ASPERULUM (Mitt.) Broth. On rocks and ledges, occasionally on tree trunks. No. MTS.: Avery Co., *L. E. A.* 4032; Burke Co., *L. E. A.* 4362, 4053; Mitchell Co., *Wetherby* '97 (NY); Yancey Co., *Schallert* '23. So. MTS.: Haywood Co., *Grout* '07 (NY); Macon Co., *Sharp* '31 (V), *L. E. A.* 4170; Swain Co., *Schallert* 59,

L. E. A. 4357; Transylvania Co., *Schallert* '23 (NY). Very common on the higher peaks of our mountains but not found at lower elevations.

DICRANODONTIUM DENUDATUM (Brid.) E. G. B. (*D. longirostre* Bryol. Eur.) Mostly on rocks. No. MTS.: Avery Co., *L. E. A.* 3982; Watauga Co., *Schallert* '23. So. MTS.: Macon Co., *Sharp* '31 (V). No. PIEDMONT: Stokes Co., *Schallert* '21. Almost rare in our region and apparently limited to montane situations, although it ranges southward to Florida. I have seen no collections of the genus from either the Piedmont or Coastal Plain except the above collection by Dr. Schallert from Cascades, Stokes Co., which is essentially montane.

CAMPYLOPUS ATROVIRENS DeNot. Bare cliffs. No. MTS.: Haywood Co., *Grout* '07 (G). The first and only collection of this European plant in this country. Collected by Dr. A. J. Grout in 1907 on the side of Chestnut Bald at an elevation of about 5900 feet. No other specimens have been seen which might be placed here, although there is the greatest variation in our species of *Campylopus*, especially in *C. introflexus* and *C. tallulensis*.

CAMPYLOPUS CAROLINAE Grout and Bartr. On sandy soil in scrub oak forest. So. COAST.: Brunswick Co., *Anderson and Evans* 6180. This is the type and only collection of this species which was recently described in Grout's Moss Flora. It was growing on bare white sand underneath the evergreen maritime forest characteristic of the coastal dunes. The type locality is only a few hundred yards south of the small village of Southport, directly opposite Fort Caswell Peninsula.

CAMPYLOPUS FLEXUOSUS Brid. On sandy soil and rocks in shaded places. No. COAST.: Franklin Co., *L. E. A.* 6293. So. COAST.: Pender Co., *L. E. A.* 6163. It is not certain that this is the correct identity for these plants. Dr. Grout thinks it highly probable that they belong here and Mr. Dixon states that it is an unusual form not like any he has seen before but that if he had found it in England he would have unhesitatingly called it *C. flexuosus*. This is the first report for North Carolina.

CAMPYLOPUS GRACILICAULIS Mitt. Sandy soil, edges of fields and in woods. So. COAST.: Brunswick Co., *L. E. A.* 6180A; Pender Co., *Blomquist* 10094; Richmond Co., *L. E. A.* 5048. First collected by the writer near Hamlet, in Richmond Co., in 1936, extending its range north from Alabama. A southern species, common in Florida, extending up the Coastal Plain as far as North Carolina and should eventually be found farther north, as it is relatively common here. Abundant on soil around the margins of granite outcrops along the Fall Line in North Carolina. On the granite outcrops of our Piedmont, however, it is replaced by *C. tallulensis*. Since the publication of the "Moss

Flora of North America" it has been found in Georgia (McVaugh and Pyron) and is probably common throughout the south Atlantic Coastal Plain. The Georgia stations are well within the Piedmont.

CAMPYLOPUS INTROFLEXUS (Hedw.) Brid. Open cliffs at high altitudes and bare sandy soil in the Coastal Plain. So. MTS.: Macon Co., Sharp '31, *L. E. A.* 4195. So. COAST.: Bladen Co., *L. E. A.* 6092. Certainly not as rare as the collections would indicate, as it is exceedingly abundant at both of the above stations. Likely overlooked elsewhere because it rarely, if ever, fruits in our region. A plant of southern affinities which ranges northward through the Coastal Plain and mountains, being absent from the Piedmont. All of the plants examined from the mountains are epilose. The Coastal Plain specimens, however, have very long hair points, in some cases longer than the rest of the leaf. Here it grows in bare sandy depressions and might easily be mistaken for an alga, being very black and usually covered with sand.

CAMPYLOPUS TALLULENSIS Sull. & Lesq. On rocks, usually growing on a thin layer of soil. No. MTS.: Avery Co., *Schallert* '23. So. MTS.: Macon Co., *Sharp* '31 (V). No. PIEDMONT: Forsyth Co., *Schallert* '24; Stokes Co., *Schallert* '23. Difficult to distinguish from epilose forms of *C. introflexus*. Our *C. tallulensis* hardly seems typical. Holzinger's 481 from Grandfather Mt., is representative of our material.

CAMPYLOPUS TALLULENSIS var. SUBLEUCOGASTER (C. Muell.) Grout. (*C. subleucogaster* Jaeger & Sauerb.) No. PIEDMONT: Stokes Co., *Schallert* '21, '26.

PARALEUCOBRYUM LONGIFOLIUM (Hedw.) Loeske. (*Dicranum longifolium* Hedw.). On rocks but with us more frequently on the trunks of trees, particularly at high altitudes. No. MTS.: Avery Co., *L. E. A.* 4041; Mitchell Co., *L. E. A.* 4103. So. MTS.: Haywood Co., *L. E. A.* 528; Jackson Co., *L. E. A.* 422; Macon Co., *Sharp* 34681 (NY), *L. E. A.* 4192; Swain Co., *L. E. A.* 3314, 3282, 3371. Very common on the peaks of the higher mountains, where it is a major epiphyte on spruce and balsam.

LEUCOBRYACEAE

LEUCOBRYUM ALBIDUM (Brid.) Lindb. On soil, decaying wood; in various situations. No. MTS.: Watauga Co., *Small* and *Heller* '91 (NY). So. MTS.: Henderson Co., *L. E. A.* 3787; Polk Co., *A. M. Small* '01 (NY); Transylvania Co., *L. E. A.* 4285. No. PIEDMONT: Durham Co., *Blomquist* 2256; Forsyth Co., *Schallert* '20; Orange Co., *Blomquist* 6553; Rockingham Co., *L. E. A.* 1198a; Vance Co., *L. E. A.* 2130. So. PIEDMONT: Gaston Co., *J. K. Small* 8006 (NY); Lee Co., *Watson* 247; Montgomery Co., *L. E. A.* 4840; Moore Co., *L. E. A.* 4805. No. COAST.: Johnston Co., *Blomquist* 4038; Martin Co.,

L. E. A. 5951; Pitt Co., *L. E. A.* 4703; Tyrrell Co., *Correll* '35; Washington Co., *L. E. A.* 5968. So. COAST.: Anson Co., *L. E. A.* 3960; Cumberland Co., *L. E. A.* 3760; Richmond Co., *L. E. A.* 5053; Robeson Co., *L. E. A.* 3788; Scotland Co., *L. E. A.* 5097. Intergrading freely with *L. glaucum*, especially in the mountains. Mostly quite distinct in the Coastal Plain, especially in the swamps, where the two species even when growing together are easily distinguished. True *L. albidum* is apparently not common in the mountains. Intermediates have mostly been referred to *L. glaucum*.

LEUCOBRYUM GLAUCUM (Hedw.) Schimp. On soil and rocks, usually in shaded places. No. MTS.: Ashe Co., *L. E. A.* 5844; Avery Co., *L. E. A.* 4029; Burke Co., *L. E. A.* 3410; Madison Co., *L. E. A.* 702; Wilkes Co., *L. E. A.* 1284. So. MTS.: Buncombe Co., *L. E. A.* 829; Haywood Co., *Blomquist* 2260; Henderson Co., *Blomquist* 2261; Jackson Co., *L. E. A.* 618; Macon Co., *L. E. A.* 4168; McDowell Co., *L. E. A.* 3055; Swain Co., *L. E. A.* 239. No. PIEDMONT: Alexander Co., *L. E. A.* 3445; Chatham Co., *L. E. A.* 2290; Davidson Co., *L. E. A.* 2397; Davie Co., *L. E. A.* 3575; Durham Co., *Blomquist* 2759; Forsyth Co., *Schallert* '20; Granville Co., *L. E. A.* 2228; Iredell Co., *L. E. A.* 3545; Randolph Co., *L. E. A.* 2350; Rockingham Co., *L. E. A.* 1207; Surry Co., *Blomquist* 6656; Vance Co., *L. E. A.* 2120; Wake Co., *L. E. A.* 3588; Warren Co., *L. E. A.* 2105. So. PIEDMONT: Cabarrus Co., *L. E. A.* 1006; Cleveland Co., *L. E. A.* 2623; Gaston Co., *L. E. A.* 2561; Lincoln Co., *L. E. A.* 3516; Montgomery Co., *L. E. A.* 4829; Rowan Co., *L. E. A.* 2475; Rutherford Co., *L. E. A.* 2655; Union Co., *L. E. A.* 4911. No. COAST.: Beaufort Co., *L. E. A.* 4649; Currituck Co., *L. E. A.* 29; Hyde Co., *L. E. A.* 4647; Johnston Co., *L. E. A.* 3614; Nash Co., *L. E. A.* 3653. So. COAST.: Anson Co., *L. E. A.* 4973; Bladen Co., *L. E. A.* 3775; Brunswick Co., *Blomquist* 2257; Hoke Co., *L. E. A.* 5104; Pender Co., *L. E. A.* 3907; Sampson Co., *L. E. A.* 3809; Scotland Co., *L. E. A.* 5092.

CALYMPERACEAE

SYRRHOPODON TEXANUS Sull. On rotten wood and moist tree trunks. No. COAST.: Beaufort Co., *L. E. A.* 4637, 4594; Hyde Co., *L. E. A.* 4651; Nash Co., *L. E. A.* 3652; Pasquotank Co., *E. Beaven* 17. So. COAST.: Harnett Co., *L. E. A.* 3720; Lee Co., *L. E. A.* 4779; Richmond Co., *Correll* 4555, *L. E. A.* 5054. A characteristic plant of the swamps of our Coastal Plain, especially on logs, stumps, and tree trunks near the water line. Quite common throughout our area, although our plants never reach the size nor form the dense mats and cushions of those farther south. We are in the range of *S. floridanus*, Miss Wickes having collected it on Long Island, N. Y., but as far as known there are no specimens from North Carolina. Having an Atlantic Coastal range identical with that of *S. texanus*, it is to be expected here.

(To be continued)

A PRELIMINARY LIST OF THE HEPATICAE OF PUERTO RICO INCLUDING VIEQUES AND MONA ISLAND

F. M. PAGÁN

(*Continued from page 50*)

HYGROLEJEUNEA CERINA (Lehm. & Lindenb.) Steph., Spec. Hep. **5**: 543. 1914. On the bark of trees and on the stems of living palms. El Yunque, 1937, *Pagán 155, 179, 195* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 262, 279* (Y.); Mte. Guilarte, Adjuntas, 1937, *Pagán 457* (P.); originally collected by *Schwanecke 40, 41, 51, 53.*

DISTRIBUTION: Brazil, West Indies.

HYGROLEJEUNEA ORBA (Gottsche) Steph., Spec. Hep. **5**: 547. 1914. On rotten logs. Indiera Baja, north of Yauco, 1923, *Britton & Britton 7238* (Y.); Maricao, 1937, *Pagán 229* (P.).

DISTRIBUTION: Common in tropical America.

LEJEUNEA CLADOGYNA Evans, Amer. Jour. Bot. **5**: 134. *f. 2.* 1918. On trees, logs and on sandy banks. Near Santurce, 1899, *Heller 616, 1365* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 542* (Y.); vicinity of Mayagüez, 1914, *E. G. Britton 1906* (Y.).

DISTRIBUTION: Florida.

LEJEUNEA ELLIOTTII Spruce, Jour. Linn. Soc. Bot. **30**: 346. *pl. 23, f. 1–6.* 1894. On rotten wood. Near Ponce, 1902, *Heller 6260* (Y.).

DISTRIBUTION: St. Vincent.

LEJEUNEA FLAVA (Sw.) Nees, Naturgesch. Eur. Leberm. **3**: 277. 1838. On bark of living trees and on palms. Vicinity of Arecibo, 1887, *Sintenis 135* (Y.); near Bayamón, 1899, *Heller 425* (Y.); north side of the Luquillo Mts., 1899, *Heller 1132, 4563, 4694* (Y.); seven miles south of Caguas, 1899, *Heller 306, 307* (Y.); near Santurce, 1899, *Heller 840* (Y.); near Aibonito, 1899, *Heller 897, 898* (Y.); vicinity of Cayey, 1900, *Evans 96 p.p.* (Y.); El Yunque, 1902, *Evans 121, 150, 187, 191* (Y.); Mt. Morales, Utuado, 1906, *Howe 809, 1092* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 597* (Y.); Mt. Morales, Utuado, 1906, *Howe, Britton & Marble 463* (Y.); vicinity of Fajardo, 1913, *N. L. Britton & J. A. Shafer 1704* (Y.); near Arecibo, 1914, *E. G. Britton 2017, 2027, 2028* (Y.); vicinity of Utuado, 1915, *E. G. Britton 5187, 5188* (Y.); between Cabo Rojo and San Germán, 1915, *N. L. Britton, Cowell & S. Brown 4319, 4324* (Y.); Hato Arriba, near Arecibo, 1915, *E. G. Britton 5112* (Y.); between Adjuntas and Jayuya, 1915, *E. G. Britton 5293* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, Cowell & S. Brown 5565, 5671* (Y.); Laguna Tortuguero, 1922, *same collectors 6856, 6859* (Y.); Indiera Baja, north of Yauco, 1923, *Britton & Britton 7079* (Y.); Bo. Guaraguao, Ponce, 1936, *Pagán 68* (P.); Maricao, 1937, *Pagán 226, 245* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 335 p.p., 342 p.p.* (P.).

DISTRIBUTION: Widely distributed in tropical regions.

LEJEUNEA FLORIDANA Evans, Bull. Torr. Bot. Club **32**: 185. *pl. 5, f. 15–21.* 1905. On bark, rotten logs and old stumps. Mt. Mandíos, near Jayuya, 1906, *Britton & Marble 965* (Y.); La Juanita, near Las Marías, 1915, *E. G. Britton 3979* (Y.); vicinity of Villalba, 1936, *Pagán 54a p.p.* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 120a* (P.).

DISTRIBUTION: Florida.

LEJEUNEA GLAUCESCENS Gottsche, G.L.N. Syn. Hep. 378. 1845. On bark. Near Utuado, 1887, *Sintenis 142* (Y.); Coamo Springs, 1901, *Underwood & Griggs 500, 531* (Y.).

DISTRIBUTION: West Indies, Brazil, Florida.

LEJEUNEA MINUTILOBA Evans, Bull. Torr. Bot. Club **44**: 525. *pl. 24, f. 1–21.* 1917. On tree trunks, roots of palms and on rocks. Near Río Piedras, 1899, *Heller 147* (Y.); near Bayamón, 1901, *Underwood & Griggs 892* (Y.); vicinity of Coamo Springs, 1906, *Howe 1371* (Y.); Ponce and vicinity, 1913, *N. L. Britton & Schafer 1747* (Y.); Lares to San Sebastián, 1913, *Britton & Marble 2799, 2800* (Y.); Candelaria, near Bayamón, 1914, *E. G. Britton 1521* (Y.); Corral Viejo, near Ponce, 1914, *E. G. Britton 5370* (Y.).

DISTRIBUTION: Bermuda, Virgin Islands.

LEJEUNEA PILILOBA Spruce, Jour. Linn. Soc. Bot. **30**: 346. *pl. 23, f. 6–8.* 1894. On bark, on the ground and on rocks. Luquillo Mts., without date, *Heller 4501* (Y.); Coamo Springs, 1901, *Underwood & Griggs 506* (Y.); Garrochales, 1916, *Stevenson 3790* (Y.); Río Portugués, near Ponce, 1923, *Britton & Britton 7427* (Y.); Guajataca, vicinity of Isabela, 1937, *Pagán 260* (P.).

DISTRIBUTION: Florida, Cuba, Dominica.

LEPTOCOLEA CARDIOCARPA (Mont.) Evans, Bull. Torr. Bot. Club **38**: 268. *pl. 12, f. 1–3.* 1911. On bark, more rarely on leaves. Seven miles south of Caguas, 1899, *Heller 288a* (Y.); north slope of the Luquillo Mts., 1899, *Heller 4562* (Y.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2157* (Y.).

DISTRIBUTION: Cuba, Mexico, Brazil, Venezuela.

LEPTOCOLEA PLANIFOLIA Evans, Bull. Torr. Bot. Club **38**: 265. *pl. 11, f. 9–16.* 1911. On living leaves. Mayagüez, 1900, *Heller, without number* (Y.); ravine near Utuado, 1906, *Britton & Marble 882 p.p.* (Y.), *the type.*

DISTRIBUTION: Honduras.

LEPTOCOLEA SCABRIFLORA (Gottsche) Evans, Bull. Torr. Bot. Club **38**: 262. *pl. 11, f. 1–8.* 1911. On leaves of shrubs and trees. Vicinity of Cayey, 1900, *Evans 70a, 72* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 536, 707* (Y.).

DISTRIBUTION: Brazil, Cuba, Jamaica, Trinidad.

LEPTOLEJEUNEA ELLIPTICA (Lehm. & Lindenb.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. I³: 126. 1893. On living leaves, more rarely on bark. Fourteen miles south of San Juan, 1899, *Heller 678, 680, 688* (Y.); south of Mayagüez, 1900, *Heller 84, 4566, 4567* (Y.); El Yunque, 1902, Evans 44 (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 685* (Y.); Río de Maricao, 1913, *E. G. Britton 2505* (Y.); near Bayamón, 1914, *E. G. Britton 1530* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, Cowell & S. Brown 5674* (Y.); east of Vega Alta, 1922, *Britton, Britton & M. S. Brown 6806* (Y.); above Villalba, *same collectors and date, 6409* (Y.); first collected by *Sintenis 45, 136.*

DISTRIBUTION: Widely distributed in subtropical and tropical America, Asia and the Pacific Islands.

LEPTOLEJEUNEA EXOCELLATA (Spruce) Evans, Bull. Torr. Bot. Club **29**: 498. *pl. 22, f. 1–13.* 1902. On living leaves. Between Aibonito and Cayey, 1899, *Heller 568, 569* (Y.); Vicinity of Cayey, 1900, *Evans 69 p.p., 70 p.p.* (Y.); Mayagüez, 1904, *G. P. Clinton, without number* (Y.); near Bayamón, 1914, *E. G. Britton 1532* (Y.); Espinosa, near Bayamón, 1915, *Stevenson 2632* (Y.); Río de Maricao, 1915, *Britton & Cowell 4241* (Y.); Bayamón, 1916, *Stevenson 3670* (Y.).

DISTRIBUTION: Peru.

LEPTOLEJEUNEA HAMULATA (Gottsche) Schiffn., Bot. Jahrb. **23**: 587. 1897. On living leaves and on stems of living palms. South of Mayagüez, 1900, *Heller 85* (Y.); vicinity of Cayey, 1900, *Evans 70b p.p.* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 738* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5486* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, Cowell & S. Brown 5663* (Y.); Indiera Fría near Maricao, 1915, *same collectors, 4545* (Y.); Mte. Torito, 1937, *Pagán 276* (P.).

DISTRIBUTION: Cuba.

LEPTOLEJEUNEA STENOPHYLLA (Lindenb. & Gottsche) Schiffn., Bot. Jahrb. **23**: 596. 1897. On living leaves. Vicinity of Cayey, 1900, *Evans 70b p.p.* (Y.); near Mayagüez, 1906, *Britton & Marble 685b* (Y.); Alto de la Bandera, 1913, *same collectors 2163* (Y.); Río de Maricao, 1913, *E. G. Britton 2506* (Y.); Maricao to Mte. Alegrillo, 1913, *E. G. Britton 2628* (Y.); Indiera Baja, north of Yauco, 1923, *Britton & Britton 7415* (Y.).

DISTRIBUTION: Mexico, Bolivia, Cuba.

LEUCOLEJEUNEA XANTHOCARPA (Lehm. & Lindenb.) Evans, Torreya **7**: 229. 1908. On trees. Vicinity of Cayey, 1900, *Evans 76* (Y.); Río de Maricao, 1913, *E. G. Britton 2530* (Y.); La Sardinera, 1926, *E. G. Britton 8523* (Y.).

DISTRIBUTION: Florida, West Indies, South America, South Africa, Java.

LOPHOLEJEUNEA HOWEI Evans, Bull. Torr. Bot. Club **34**: 30. *pl. 4, f. 9–20.* 1907. On trees. Coamo to Caguas, 1906, *Howe 1413 p.p.* (Y.), *the type;* Río de Maricao, 1913, *E. G. Britton 2507* (Y.).

DISTRIBUTION: Jamaica.

LOPHOLEJEUNEA MUELLERIANA (Gottsche) Schiffn., Bot. Jahrb. **23**: 599. 1897. On trees. North slope of the Luquillo Mts., 1899, *Heller 783* (Y.); El Yunque, 1902, *Evans 124* (Y.).

DISTRIBUTION: Florida, Mexico, Jamaica, Martinique, Guiana, Venezuela.

LOPHOLEJEUNEA SAGRAEANA (Mont.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 129. 1893. On the bark of trees and on rotten logs. Vicinity of Cayey, 1900, *Evans 85* (Y.); Coamo to Caguas, 1906, *Howe 1412* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 649 p.p.* (Y.); vicinity of Barranquitas, 1915, *E. G. Britton 5576* (Y.); Indiera Baja, north of Yauco, 1923, *Britton & Britton 7403* (Y.).

DISTRIBUTION: West Indies, Florida, Mexico, Brazil, Bolivia, Africa, East Indies.

MACROLEJEUNEA SUBSIMPLEX (Mont.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 125. 1893. On living trees and on rotten logs. North slope of the Luquillo Mts., 1899, *Heller 1136, 1146, 4635, 4636* (Y.); north of Cayey, 1901, *Underwood & Griggs 282 bis* (Y.); El Yunque, 1900, *Evans 47* (Y.); El Yunque, 1902, *Evans 60, 70, 128* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 741* (Y.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2183* (Y.); Loma la Mina, Sierra de Naguabo, 1914, *Shafer 3303* (Y.); Río de Maricao, 1915, *N. L. Britton & Cowell 4247* (Y.); Indiera Baja, north of Yauco, 1923, *Britton & Britton 740, 7235, 7244* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7737* (Y.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 81, 106* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 264* (P.); Maricao, 1937, *Pagán 208* (P.); El Yunque, 1937, *Pagán 567 p.p.* (P.).

DISTRIBUTION: Widely distributed in the West Indies, Venezuela, Colombia, Brazil, Mexico, Ecuador, Peru, Galapagos Islands.

MARCHESINIA BRACHIATA (Sw.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 128. 1893. On trees, rotten logs and on rocks. North slope of the Luquillo Mts., 1899, *Heller 1145* (Y.); El Yunque, 1902, *Evans 59* (Y.); Mt. Morales, Utuado, 1906, *Howe 1088, 1106, 1127, 1136* (Y.); Doña Juana Waterfall, Toro Negro, 1922, *Britton, Britton & M. S. Brown 6212* (Y.); vicinity of Coamo Springs, 1922, *same collectors 5978* (Y.); Doña Juana Waterfall, above Villalba, 1936, *Pagán 47* (P.); Maricao, 1937, *Pagán 235* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 429* (P.).

DISTRIBUTION: West Indies, South America, Galapagos Islands.

MASTIGOLEJEUNEA AURICULATA (Wils. & Hook.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 129. 1893. On trees, rotten logs and on rocks. Near Mayagüez, 1900, *Heller 462, 463* (Y.); Arecibo to Utuado, 1906, *Howe 378* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 649 p.p.* (Y.); Mona Island, 1914, *N. L. Britton, Cowell &*

Hess 1680, 1681, 1690, 1693 (Y.); Lares to San Sebastián, 1913, *Britton & Marble 2796* (Y.); La Juanita, near Las Marías, 1915, *E. G. Britton 3974* (Y.); Loíza, 1915, *N. L. Britton, B. H. Dutcher & S. Brown 5743* (Y.); vicinity of Dorado, 1922, *Britton, Britton & M. S. Brown 6716* (Y.).

DISTRIBUTION: Florida, Alabama, Louisiana, Mexico, Bahama Islands, Cuba, Haiti, Jamaica, Colombia, Surinam, Brazil, Paraguay, Peru.

MICROLEJEUNEA BULLATA (Tayl.) Evans, Mem. Torr. Bot. Club **8**: 164. *pl. 21, f. 20–29.* 1902. On bark and on rocks. Without definite date or locality, *Sintenis 100*, as *M. ovifolia* Gottsche.

DISTRIBUTION: South Carolina, Florida, West Indies, Brazil, Peru, Ecuador.

MICROLEJEUNEA LAETEVIRENS (Nees & Mont.) Evans, Bryologist **11**: 68. 1908. On the bark of trees. Between Aibonito and Cayey, 1899, *Heller 565* (Y.); Luquillo Mts., 1899, *Heller 4543* (Y.); near Ponce, 1899, *Heller 6306, 6340* (Y.); El Yunque, 1900, *Evans 40* (Y.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2174* (Y.); near Maricao, *N. L. Britton, Cowell & S. Brown 4422* (Y.); Sierra de Yabucoa, 1922, *Britton, Britton & Earle 6316* (Y.); Guayama-Cayey Road, 1922, *same collectors 6468* (Y.); Cerro de Las Piñas, near Las Cruces, 1922, *N. L. Britton, J. Matz & C. E. Chardón 6907* (Y.); Bo. Guaraguao, Ponce, 1936, *Pagán 4* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 77 p.p.* (P.); Bo. Guaraguao, Ponce, 1937, *Pagán 452* (P.); near Maricao, 1937, *R. H. Moore 11* (P.).

DISTRIBUTION: Virginia, Florida to Louisiana, tropical America.

NEUROLEJEUNEA BREUTELII (Gottsche) Evans, Bull. Torr. Bot. Club **34**: 13. *pl.1. f. 17–23.* 1907. On trees and on rocks. Río de Maricao, 1913, *E. G. Britton 2496* (Y.); Río de Maricao, 1915, *N. L. Britton & J. F. Cowell 4244, 4250, 4253* (Y.); Maricao, 1937, *Pagán 238* (P.); near Maricao, 1937, *Moore 3* (P.); without definite dates or localities, *Schwanecke, Sintenis 23.*

DISTRIBUTION: St. Kitts, Guadeloupe, Dominica, Martinique, Jamaica.

NEUROLEJEUNEA CATENULATA (Nees) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 131. 1893. On the bark of trees and on logs. El Yunque, 1902, *Evans 119, 143, 144* (Y.).

DISTRIBUTION: Jamaica.

ODONTOLEJEUNEA LUNULATA (Web.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**^{3}: 128. 1893. On living leaves. Sierra de Yabucoa, 1922, *Britton, Britton & Earle* 6317 (Y.); without definite date, locality or number *Balbis.*

DISTRIBUTION: widely distributed in tropical America; also found in Africa.

ODONTOLEJEUNEA SIEBERIANA (Gottsche) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. I³: 127. 1893. On living leaves. El Yunque, 1902, *Evans 182* (Y.); Mte. Morales, Utuado, 1906, *Howe 1094* (Y.); Alto de la Bandera, near Adjuntas, 1913, *Britton & Marble 2161, 2218* (Y.); Indiera Fría, near Maricao, 1915, *N. L. Britton, Cowell & S. Brown 4391* (Y.); Santa Rosa, near Los Picachos, Jayuya, 1937, *Pagán 317a p.p.* (P.).

DISTRIBUTION: Peru, Ecuador, Mexico, Brazil, Cuba, Jamaica, St. Vincent, Dominica, Mauritius.

OMPHALANTHUS FILIFORMIS (Sw.) Nees, G.L.N. Syn. Hep. 304. 1845. On trees and on rocks. Luquillo Mts., 1885, *Sintenis 36* (Y.); El Yunque, 1900, *Evans 12, 56* (Y.); El Yunque, 1902, *Evans 54* (Y.); Luquillo Mts., 1912, *Bro. Hioram 426* (Y.); Sierra de Naguabo, 1914, *Shafer 3756, 3772* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7745, 7750* (Y.); Cerro de Punta, Jayuya, 1937, *Pagán 352* (P.); El Yunque, 1937, *Pagán 470, 520a, 531* (P.); without definite date, locality or number, *Schwanecke.*

DISTRIBUTION: Jamaica, St. Kitts, Guadeloupe, Dominica, Martinique; also been reported from the Galapagos Islands. On the mainland its range extends from Mexico to Bolivia.

PRIONOLEJEUNEA AEMULA (Gottsche) Evans, Bull. Torr. Bot. Club **31**: 219. *pl. 11, f. 18–28.* 1904. On a rotten log. El Yunque, 1902, *Evans 103 p.p.* (Y.); Sierra de Naguabo, 1914, *N. L. Britton & J. F. Cowell 3129* (Y.); Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7733* (Y.).

DISTRIBUTION: St. Kitts, Dominica.

PRIONOLEJEUNEA AEQUITEXTA Evans, Bull. Torr. Bot. Club **31**: 217. *pl. 11, f. 1–17.* 1904. On shaded rocks. El Yunque, 1902, *Evans 129, 169* (Y.). No. *169* is the type.

DISTRIBUTION: Known only from Puerto Rico.

PRIONOLEJEUNEA EXAURICULATA Evans, Bull. Torr. Bot. Club **31**: 223. *pl. 12, f. 14–28.* 1904. On shaded rocks. El Yunque, 1902, *Evans 179* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

PRIONOLEJEUNEA HELLERI Evans, Bull. Torr. Bot. Club **31**: 221. *pl. 12, f. 1–13.* 1904. On roots of tree ferns. North slope of the Luquillo Mts., 1900, *Heller 4633* (Y.); El Yunque, 1902, *Evans 148* (Y.); *the type;* mountain between Guayama and Cayey, 1922, *Britton, Britton & M. S. Brown 6609* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

PRIONOLEJEUNEA INNOVATA Evans, Bull. Torr. Bot. Club **31**: 215. *pl. 10, f. 18–27.* 1904. On roots of tree ferns. North slope of the Luquillo Mts., 1900, *Heller 4637* (Y.), *the type.*

DISTRIBUTION: Known only from Puerto Rico.

PTYCHOCOLEUS POLYCARPUS (Nees) Trevis., Mem. r. Ist. Lomb. III. **4**: 405. 1877. On trees. Between Cayey and Caguas, 1906, *Howe 1411 p.p., 1414* (Y.).
DISTRIBUTION: Brazil, Mexico, Cuba, Santo Domingo, Jamaica.

PYCNOLEJEUNEA PAPULOSA Steph., Hedwigia **35**: 126. 1896. On trees. North side of the Luquillo Mts., 1899, *Heller 1163* (Y.).
DISTRIBUTION: Tropical America.

PYCNOLEJEUNEA SCHWANECKEI (Steph.) Schiffn., Bot. Jahrb. **23**: 594. 1897. On bark of trees. North side of the Luquillo Mts., 1900, *Heller 4739* (Y.); El Yunque, 1902, Evans 73 (Y.); El Yunque, 1937, *Pagán 150a, 187* (P.); type specimens collected by *Schwanecke*.
DISTRIBUTION: Jamaica.

RECTOLEJEUNEA BERTEROANA (Gottsche) Evans, Bull. Torr. Bot. Club **33**: 12. 1906. On the bark of trees. Mt. Morales, Utuado, 1906, *Howe 1123* (Y.). *Bertero*, the type locality.
DISTRIBUTION: Cuba, Southern Florida, Bahama Islands.

RECTOLEJEUNEA BRITTONIAE Evans, Bull. Torr. Bot. Club **38**: 209. *pl. 9, f. 1–12*. 1911. On bark. Vicinity of Dorado, 1922, *Britton, Britton & M. S. Brown 6718* (Y.); vicinity of Vega Baja, 1922, *same collectors 6961* (Y.); limestone hills east of Vega Baja, 1923, *Britton & Britton 7134* (Y.).
DISTRIBUTION: Florida, Cuba, Bahamas Islands, Santo Domingo.

RECTOLEJEUNEA EMARGINULIFLORA (Gottsche) Evans, Bull. Torr. Bot. Club **33**: 14. *pl. 2, f. 1–8*. 1906. On the bark of trees. North slope of the Luquillo Mts., 1899, *Heller 4741 p.p.* (Y.).
DISTRIBUTION: Cuba.

RECTOLEJEUNEA FLAGELLIFORMIS Evans, Bull. Torr. Bot. Club **33**: 9. *pl. 1, f. 10–25*. 1906. On the bark of trees. Luquillo Mts., 1899, *Heller 1135* (Y.); El Yunque, 1902, *Evans 29* (Y.); Mt. Morales, Utuado, 1906, *Howe 1133* (Y.).
DISTRIBUTION: Cuba.

RECTOLEJEUNEA MAXONII Evans, Bull. Torr. Bot. Club **39**: 609. *pl. 45, f. 17–27*. 1912. On the bark of trees. Mt. Morales, Utuado, 1906, *Howe 453* (Y.).
DISTRIBUTION: Jamaica, southern United States.

RECTOLEJEUNEA PHYLLOBOLA (Nees & Mont.) Evans, Bull. Torr. Bot. Club **33**: 15. 1906. On the bark of trees. Without definite locality, 1901, *Underwood & Griggs 893* (Y.); Caguas Road, 1899, *Heller 940* (Y.); Mayagüez, 1900, *Heller 86* (Y.); vicinity of Utuado, 1906, *Howe, Britton & Cowell 872* (Y.); vicinity of Fajardo, 1913, *Britton & Shafer 1551* (Y.).
DISTRIBUTION: Widely distributed in the West Indies; also known from Mexico, Costa Rica, and southern Florida.

STICTOLEJEUNEA SQUAMATA (Willd.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. I³: 131. 1893. On the bark of trees, more rarely on rocks. Without definite date or locality, *Sintenis 49* (Y.); vicinity of Cayey, 1900, *Evans 84* (Y.); El Yunque, 1902, *Evans 134, 173, 192, 195* (Y.); Mt. Morales, Utuado, 1906, *Howe 1100* (Y.).

DISTRIBUTION: Cuba, Haiti, Jamaica, St. Vincent, Dominica, Guadeloupe, Brazil, Costa Rica.

STREPSILEJEUNEA INVOLUTA (Gottsche) Steph., Spec. Hep. **5**: 282. 1913. On trees and shaded rocks. Without definite date or locality, *Sintenis 95* (Y.); north slope of the Luquillo Mts., 1899, *Heller 4655* (Y.); El Yunque, 1902, *Evans 156* (Y.); Maricao to Mte. Alegrillo, 1913, *E. G. Britton 2651, 2652, 2679* (Y.); Maricao, 1916, *H. H. Whetzel, without number* (Y.); vicinity of Adjuntas, 1937, *Pagán 443 p.p.* (P.); El Yunque, 1937, *Pagán 543* (P.); also collected by *Schwanecke*.

DISTRIBUTION: West Indies, Brazil.

SYMBIEZIDIUM BARBIFLORUM (Lindenb. & Gottsche) Evans, Bull. Torr. Bot. Club **34**: 540. *pl. 31, f. 11–14.* 1908. On the bark of living trees and on rotten logs. Without definite date, locality or number, *Schwanecke;* north slope of the Luquillo Mts., 1899, *Heller 779* (Y.); Maricao, 1937, *Pagán 119b, 239* (P.).

DISTRIBUTION: Surinam, Cuba, Guadeloupe.

SYMBIEZIDIUM GRANULATUM (Nees) Trevis., Mem. r. Ist. Lomb. III. **4**: 403. 1877. On trees. In Mte. Luquillo, 1847–50, *Schwanecke without number* (F.).

DISTRIBUTION: Brazil, Surinam, Ecuador, St. Vincent.

SYMBIEZIDIUM TRANSVERSALE (Sw.) Trevis., Mem. r. Ist. Lomb. III. **4**: 403. 1877. On trees. Sierra de Naguabo, 1885, *Sintenis 2* (Y.); north slope of the Luquillo Mts., 1899, *Heller 784, 1144, 1159, 1161, 4761* (Y.); El Yunque, 1902, *Evans 25, 67, 126* (Y.); Río de Maricao, 1913, *E. G. Britton 2678* (Y.); Maricao, 1937, *Pagán 216* (P.); Mte. Torito, Canóvanas, 1937, *Pagán 272* (P.); El Yunque, 1937, *Pagán 510* (P.).

DISTRIBUTION: Jamaica, Cuba, St. Kitts, Dominica.

SYMBIEZIDIUM VINCENTINUM (Gottsche) Trevis., Mem. r. Ist. Lomb. III. **4**: 403. 1877. Without definite date or locality *Sintenis 64;* Sierra de Naguabo, 1914, *N. L. Britton & W. E. Hess 2309* (Y.).

DISTRIBUTION: Tropical America.

TAXILEJEUNEA ANTILLANA Steph., Hedwigia **27**: 281. *pl. 11, f. 4 & 5.* 1888. Without definite date or locality, *Sintenis 46, 113.*

DISTRIBUTION: Known only from Puerto Rico.

TAXILEJEUNEA EGGERSIANA Steph., Hedwigia **27**: 285. 1888. On the bark of trees, dead logs, shaded banks and on wet rocks. Arecibo to Utuado, 1906, *N. L. Britton & J. F. Cowell 332, 349* (Y.); Finca

Alvarez, Quebradillas, 1913, *Bro. Hioram 15* (Y.); Hato Arriba, near Arecibo, 1914, *E. G. Britton 2029, 2030b* (Y.); same locality, 1915, *E. G. Britton 5118* (Y.); Las Dos Bocas, 1915, *Stevens 967* (Y.); Mte. Torrecilla, 1915, *N. L. Britton, Cowell & S. Brown 5681* (Y.); near Utuado, 1923, *Britton & Britton 7533* (Y.).

DISTRIBUTION: Known only from Puerto Rico.

TAXILEJEUNEA OBTUSANGULA (Spruce) Evans, Bull. Torr. Bot. Club **38**: 215. *pl. 10, f. 1–17.* 1911. On the bark of trees and on limestone rocks. Lighthouse, Arecibo, 1914, *N. L. Britton & J. F. Cowell 1924, 1928, 1929* (Y.); above Villalba, 1922, *E. G. Britton & M. S. Brown 6222* (Y.); vicinity of Trujillo Alto, 1922, *same collectors 7047* (Y.).

DISTRIBUTION: Brazil, Florida, Bahama Islands, Virgin Islands.

TAXILEJEUNEA SULPHUREA (Lehm. & Lindenb.) Schiffn., in Engler & Prantl, Natür. Pflanzenfam. **I**[3]: 125. 1893. On living trees. Without definite date or locality *Sintenis 40;* Cerro de Las Piñas, near Las Cruces, 1922, *N. L. Britton, J. Matz & C. E. Chardón 6913* (Y.); El Yunque, 1937, *Pagán 144a, 147* (P.); Mte. Guilarte, Adjuntas, 1937, *Pagán 433a, 434, 441a* (P.).

DISTRIBUTION: Tropical America.

TRACHYLEJEUNEA AQUARIUS (Spruce) Evans, Bull. Torr. Bot. Club **30**: 561. *pl. 22, f. 11.* 1903. On the bark of trees. North slope of the Luquillo Mts., without date, *Heller 4745* (Y.); El Yunque, 1900, *Evans 189 p.p.* (Y.).

DISTRIBUTION: Tropical America.

FRULLANIACEAE

FRULLANIA ARIETINA Tayl., G.L.N. Syn. Hep. 413. 1845. On trees and on rotten logs. Adjuntas, 1886, *Sintenis 76* (Y.); vicinity of Cayey, 1900, *Evans 75, 78, 99* (Y.); western end of Laguna Tortuguero, 1922, *E. G. Britton & M. S. Brown 6858* (Y.).

DISTRIBUTION: Widely distributed in tropical America. Found also in Florida.

FRULLANIA ATRATA (Sw.) Nees, G.L.N. Syn. Hep. 463. 1845. On trees and on rocks. Luquillo Mts., 1885, *Sintenis 14* (Y.); El Yunque, 1900, *Evans 49* (Y.); El Yunque, 1902, *Evans 50* (Y.); El Yunque, 1937, *Pagán 148a* (P.).

DISTRIBUTION: West Indies, Guiana, Brazil, Venezuela, Ecuador, Mexico.

FRULLANIA BRASILIENSIS Raddi, Mem. Soc. Ital. Mod. Fis. **19**: 36. 1823; **20**: *pl. 3, f. 2.* 1829. On wet rocks and on dead wood. Catalina-Yunque trail, Luquillo Mts., 1923, *E. G. Britton 7643, 7739* (Y.).

DISTRIBUTION: Widely distributed in the American tropics.

FRULLANIA GIBBOSA Nees, G.L.N. Syn. Hep. 411. 1845. On trees,

on the ground and on rocks. Lares, 1913, *Britton, Britton & Hess 2767* (Y.).

DISTRIBUTION: West Indies, French and British Guiana, Brazil, Mexico, Colombia, Peru, Chile, Barbados, Alabama.

FRULLANIA HIANS (Lehm. & Lindenb.) Mont. & Nees, Fl. Boliv. d'Orbigny. Voy. dans l'Amér. Mérid. **72**: 69. 1839. On rocks and on trees. Mt. Mandíos, near Jayuya, 1906, *Britton & Marble 963* (Y.); Mt. Morales, Utuado, 1906, *E. G. Britton 496, 497* (Y.); Mte. Torrecilla, 1911, *Bro. Hioram 13* (Y.).

DISTRIBUTION: From the West Indies and Mexico, through Costa Rica, Colombia, Ecuador, and Brazil, to Bolivia and Argentina.

FRULLANIA KUNZEI Lehm. & Lindenb., G.L.N. Syn. Hep. 449. 1846. On bark, old logs and on rocks. Vicinity of Cayey, 1900, *Evans 98* (Y.); El Yunque, 1902, *Evans 48* (Y.); Mt. Morales, Utuado, 1906, *Howe 464* (Y.); vicinity of Utuado, 1915, *E. G. Britton, 5189* (Y.); vicinity of Ala de la Piedra, above Villalba, 1922, *E. G. Britton, & M. S. Brown 6220* (Y.).

DISTRIBUTION: Southern United States, West Indies, Brazil.

FRULLANIA NODULOSA (Reinw., Bl., Nees) Nees, G.L.N. Syn. Hep. 433. 1845. On trees, on rocks and on the ground. Río de Maricao, 1915, *N. L. Britton & J. F. Cowell 4252* (Y.); first collected by *Schwanecke* under the name of *F. Thuillierii* Nees.

DISTRIBUTION: Asia, eastern Africa, eastern Australia, West Indies, South America.

FRULLANIA RIOJANEIRENSIS (Raddi) Spruce, Trans. & Proc. Edinb. Bot. Soc. **15**: 23. 1884. On the bark of trees, on logs and on rocks. Vicinity of Cayey, 1900, *Evans 91* (Y.); Mt. Morales, Utuado, 1906, *Howe 484, 814, 1096* (Y.); vicinity of Mayagüez, 1906, *Britton & Marble 591* (Y.); Mt. Morales, Utuado, 1906, *Britton & Marble 837* (Y.); Bo. Guaraguao, Ponce, 1936, *Pagán 9* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 83* (P.); Bo. Rucio, Peñuelas, 1937, *Pagán 464, 465* (P.); also collected by *Sintenis 48, 54.*

DISTRIBUTION: Widely distributed in tropical America. Also found in Florida.

FRULLANIA SQUARROSA (Reinw., Bl., Nees) Dumort., Recueil d'Obs. sur les Jung. 13. 1835. On trees, on logs and on rocks. Utuado, 1901, *Underwood & Griggs 18* (Y.); Mona Island, 1914, *N. L. Britton, Cowell & Hess 1725, 1796, 1800, 1860a* (Y.); vicinity of Utuado, 1915, *E. G. Britton 5186* (Y., N.).

DISTRIBUTION: Widely distributed in tropical and subtropical regions, extending as far north in the United States as Connecticut.

ANTHOCEROTACEAE

ANTHOCEROS CAROLINIANUS Mich., Fl. Bor.-Amer. **2**: 280. 1803. On rocks and on damp banks. Near Aguas Buenas, 1929, *Britton & Britton 9195* (N.).

DISTRIBUTION: Connecticut, Florida, Georgia, South Carolina, North Carolina, Virginia, New Jersey.

ANTHOCEROS COMMUNIS Steph., Bull. Herb. Boiss. **5**: 86. 1897. On wet rocks and on the ground. Back of garage, Governor's summer residence, Guayama Road, 1924, *Britton & Britton 7993* (Y., N.); Matrullas, Orocovis, 1936, *Pagán 21* (P.); Mte. Cerrote, near Adjuntas, 1937, *Pagán 94* (P.).

DISTRIBUTION: Widely distributed in tropical regions.

ANTHOCEROS KUNZEANUS Steph., Spec. Hep. **5**: 981. 1916. Collected by *Dr. Otto Kunze*, without date, locality or number (N., F.).

DISTRIBUTION: Known only from Puerto Rico.

ANTHOCEROS LAEVIS L., Spec. Pl. 1139. 1753. On moist banks and on rocks. Cayey, 1874, *without number or collector's name* (N.).

DISTRIBUTION: Widely distributed in Europe, Asia and North America; found also in Bermuda.

DENDROCEROS CRISPUS (Sw.) Nees, G.L.N. Syn. Hep. 581. 1846. On logs and on the soil. El Yunque, 1900, *Evans 27* (Y.); El Yunque, 1902, *Evans 84* (Y.); Mte. Cerrote, near Adjuntas, 1915, *N. L. Britton & S. Brown 5478* (Y.); Mte. Torito, Canóvanas, 1937, *Pagán 375, 407* (P.).

DISTRIBUTION: Guadeloupe, St. Vincent.

MEGACEROS ALATIFRONS Steph., Spec. Hep. **5**: 947. 1916. On rotten wood and on rocks. Mte. Guilarte, Adjuntas, 1937, *Pagán 559* (P.).

DISTRIBUTION: Guadeloupe.

MEGACEROS VINCENTIANUS (Lehm. & Lindenb.) Campb., Ann. Bot. **21**: 472. *pl. 44, f. 19.* 1907. On rotten logs and on rocks. Mt. Morales, Utuado, 1906, *Howe 858, 1109* (Y., N.); Mte. Torrecilla, 1915, *N. L. Britton, Cowell & S. Brown 5686* (Y.); El Yunque, 1937, *Pagán 188* (P.); Bo. Cialitos, Jayuya, 1937, *Pagán 339* (P.).

DISTRIBUTION: Guadeloupe, St. Vincent.

NOTOTHYLAS BREUTELII Gottsche, Bot. Zeit. **16**: 21. 1858. On rocks and on clay banks. Vicinity of Cayey, 1900, *Evans 64* (Y.), Santa Isabel, 1912, *Johnston 204* (Y.); Coamo Springs, 1913, *Britton & Marble 2344* (Y.); vicinity of Río Piedras, 1937, *Pagán 161* (P.).

DISTRIBUTION: Louisiana, Cuba, Virgin Islands.

EXCLUDED SPECIES

In the "Expositio Hepaticarum Portoricensium" of Hampe and Gottsche[1] as well as in Stephani's "Westindische Hepaticae,"[2] *Symphyogyna sinuata* (Sw.) Nees & Mont., and *Leptocolea marginata*

[1] Linnaea **25**: 356 and 357. 1852.
[2] Hedwigia **27**: 287 and 289. 1888.

(Lehm. & Lindenb.) Evans, were reported from Puerto Rico. A thorough study of these species by Professor A. W. Evans[1] pointed to the conclusion that *S. sinuata* was to be found only in Jamaica; and that the material upon which the record of *L. marginata* was based, most likely can be referred to *Diplasiolejeunea pellucida* (Meissn.) Shiffn. In view of these facts it is better to consider that the two species are not yet known from Puerto Rico. Likewise, *Drepanolejeunea hamatifolia* (Hook.) Schiffn., *D. tenuis* (Reinw., Bl., Nees) Schiffn.[2] and *Prionolejeunea denticulata* (Web.) Schiffn.[3] are to be regarded as doubtful members of the hepatic flora of Puerto Rico.

THE UNIVERSITY OF PUERTO RICO,
RÍO PIEDRAS, PUERTO RICO.

REVIEWS

GERHARD ÅBERG. Några Sphagnumfynd i Värmland—jämte en kort översikt rörande Sphagnas allmänna formbildningar. Meddel. från Värmlands Naturhist. Förening **4**: 1–31, 1933. Untersuchungen über die Sphagnum-Arten der Gruppe Subsecunda in Europa mit besonderer Berücksichtigung ihres Auftretens in Schweden. Arkiv för Botanik **29A** (1): 1–77, 1937.—In 1883, C. Jensen made a study of the analogous variations in species of *Sphagnum*, and Russow, in 1887, developed a system of form-names to describe gross features appearing in *Sphagnum* types, which are rather well known, *anoclada* and *dasydrepanoclada*, for example. Dr. Åberg offers a method, based on this work, by which the gross appearance of a given sample of a species or variety of *Sphagnum* can be described in its form-name to any degree of detail which might seem desirable. Devices are made available to designate approximate and intermediate types, and to show if a secondary trait is also strongly present in the plants. There is much to be said for the general adoption of a method such as this, to name forms of species of *Sphagnum*, particularly when made such a logical basis for study as done by Dr. Åberg.

Thus great interest is aroused when Dr. Åberg regards such variations as due to the degree of "hydrophytism" or "water-modification" of a given species or variety. He finds certain traits unchanged in a species whether immersed or not, therefore *hydrostabila* and of genotypic significance; on the other hand, much variation is found to be due to water modification, hence *hydrolabila*.

In separate studies *S. pulchrum* (Lindb.) Warnst. is reduced to a

[1] Bull. Torr. Bot. Club **38**: 262. 1911; Trans. Conn. Acad. **27**: 13. 1925.
[2] Bull. Torr. Bot. Club **30**: 19. 1903.
[3] Bull. Torr. Bot. Club **31**: 214. 1904.

variety of *S. recurvum* Beauv.; the variety *septiculatum* is described as new for *S. cuspidatum* Ehrh. on the basis of characteristics considered to be genotypic; the variety *serrulatum* Schlieph. of *S. cuspidatum* is reduced to forma *serrulata;* and a forma *plumosa* is described for the relatively xerophytic *S. acutifolium* Ehrh.

The treatment of *Subsecunda* is noteworthy. The pore structure and stem and leaf types of this group are studied minutely. Part of the pore structure is explained as being hydrostable in nature, but characteristic trends are found to be hydrolabile, and a terminology is developed to treat as forms the variations thus produced. A large number of specimens are analyzed and grouped in several tables. The many proposed European species of this group are reduced to a few species and varieties, with stages of water-modification: *S. Pylaiei* Brid., *S. contortum* Schultz and var. *platyphyllum*, *S. subsecundum* Nees and vars. *inundatum*, *bavaricum*, *auriculatum*, and *rufescens*.

There are introduced as occurring in *Subsecunda*, and given form-names, various stages of "rejuvenated" plants (impoverished growths due to general sprouting from partly dead material, which simulate juvenile stages, as noted by C. Warnstorf in "Sphagnologia Universalis," 1911), which have caused the naming of many unsound species. Dr. Åberg thinks parallel trends due to hydrophytism also occur. Experiments by H. Paul ("Der Einfluss des Wassers auf die Gestaltungsverhältnisse der Sphagna," 1932) have produced this irregularity; however, as Dr. Åberg points out, the direct transfer of material in Paul's water cultures gives no good indication of the results of hydrophytism as they occur in nature, but at least hydrophytic isophyllism has been experimentally demonstrated to some extent. Experiments of this sort are, of course, much needed.

These studies by Dr. Åberg seem of great significance in the investigation of the perplexing genus *Sphagnum*. They have been confined chiefly as yet to parts of the groups *Subsecunda* and *Cuspidata*, and although these groups possess water-forms in the most marked degree, general extension of this type of study throughout the field would seem desirable.—HOLLIS KOSTER, GREEN BANK, NEW JERSEY.

A. J. GROUT. North American Musci Perfecti Nos. 326–350. Newfane, Vt. 1938.—Another series of Dr. A. J. Grout's exsiccati of North American mosses appeared in August, 1938. Those of us accustomed to scanning through a moss manual and looking with wonder at descriptions and illustrations of plants remote from our collecting fields may have the opportunity of seeing some of these plants in the well fruited specimens issued in the current series.

Eight pygmies of mossland are of special interest. Three closely related genera from the Atlantic region aptly appear together and are well represented by *Bruchia flexuosa*, *B. Donnellii* and *B. Drum-*

mondii, *Pleuridium Sullivantii*, and *P. Ravenelii*, and *Archidium Donnellii*. Two small mosses from the west are *Grimmia plagiopoda* and *Pterygoneuron ovatum*. The *Grimmia* is common in sandstone regions and is widely distributed on both sides of the Rocky Mountains. *P. ovatum*, from Washington, is widely distributed in this country but is especially abundant on soil in desert regions.

Oncophorus Rauei, from Tennessee, is apparently rare and of limited distribution while *Entodon brevisetus*, from Maine, is uncommon but widely distributed in the northeastern quarter of the United States.

The complete series is as follows: 326. *Bryum affine* (Bruch) Lindb., Vermont; 327. *Bryum uliginosum* (Bruch) Bry. Eur., Michigan; 328. *Mnium Drummondii* Bry. Eur., Maine; 329. *Sphagnum compactum* D. C., Vermont; 330. *Climacium Kindbergii* (R. & C.) Grout., New York; 331. *Grimmia plagiopoda* Hedw., Colorado; 332. *Fontinalis neomexicana* Sull. & Lesq., Montana; 333. *Pleuridium Ravenelii* Aust., N. Carolina; 334. *Entodon brevisetus* (Hook. & Wils.) J. & S., Maine; 335. *Pleuridium Sullivantii* Aust., N. Carolina; 336. *Bruchia Drummondii* Hpe., N. Carolina; 337. *Bruchia Donnellii* Aust., N. Carolina; 338. *Pterygoneuron ovatum* Hedw., Washington; 339. *Thelia hirtella* (Hedw.) Sull., New York; 340. *Amblystegium Juratzkanum* Schimp., Vermont; 341. *Orthotrichum sordidum* Lesq. & James, Vermont; 342. *Polytrichum gracile* Sm., Michigan; 343. *Timmia austriaca* Hedw., British Columbia; 344. *Archidium Donnellii* Aust., N. Carolina; 345. *Oncophorus Rauei* (Aust.) Grout, Tennessee; 346. *Mnium cinclidioides* (Blytt) Hueben., Maine; 347. *Bruchia flexuosa* (Schwaegr.) C. M., Georgia; 348. *Plagiothecium denticulatum* (Hedw.) Bry. Eur., Ontario; 349. *Hypnum pratense* Koch., Maine; 350. *Mnium stellare* Reich., Maine.—SEVILLE FLOWERS, UNIVERSITY OF UTAH, SALT LAKE CITY, UTAH.

NOTES

The 1939 Foray of the Sullivant Moss Society will be held jointly with the eastern summer meeting of the Botanical Society of America and the American Society of Plant Taxonomists, June 16–18, at the Mountain Lake Biological Station, Mountain Lake, Virginia.

Mr. Robert S. Williams, Research Associate in Bryology at the New York Botanical Garden, who is distinguished for his work on the mosses of Arctic and tropical America, as well as the Philippine Islands, celebrated his eightieth birthday May 6, 1939. It is appropriate to point out here that Mr. Williams was President of the Sullivant Moss Society from 1924 to 1931, the longest term of office that any President has yet served.

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CONTENTS

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†GEORGE ELWOOD NICHOLS
April 12, 1882–June 20, 1939
President of the Sullivant Moss Society
1938–1939

A STUDY OF NARDIA LESCURII*

MARY S. TAYLOR

The original material of *Nardia Lescurii* was collected by Leo Lesquereux, in 1859, at Tallulah Falls, Georgia, and distributed by Austin, in 1873, under the name *Alicularia Lescurii*, n. sp. in his Hepaticae Boreali-Americanae, (No. 5). On the label of this number he stated that the new species differed from *Alicularia scalaris* in its emarginate-bilobed leaves. Two years later (1, p. 18) he published a fuller account, stating that the leaves were much like those of *Sarcoscyphus emarginatus*, but that the leaf-cells and amphigastria were like those of *A. scalaris*. He added that the material was sterile and that the prostrate stem and leaf-bases were "rather copiously radiculose."

In 1884 Underwood (15, p. 115) changed the name of the species to *Nardia Lescurii*. In 1901, however, Stephani (14, p. 481) threw doubts on its validity by including it as a possible synonym of *Alicularia minor* (Nees) Limpricht, a species now known as *Alicularia geoscypha* DeNot. or *Nardia geoscypha* (DeNot.) Lindb. Then in 1914 Evans (5, p. 89) upheld the validity of *N. Lescurii* and showed that its unisexual character distinguished it from the paroicous *Nardia geoscypha*. For a long time *Nardia Lescurii* was known only from Tallulah Falls, Georgia, and vicinity. The writer is now able to record it from various localities in Ohio, West Virginia, Kentucky, North Carolina, and South Carolina.

* Papers from the Department of Botany, The Ohio State University, No. 405.

NARDIA LESCURII (AUST.) UNDERWOOD

Alicularia Lescurii Austin, Hep. Bor.-Amer. No. 5. 1873; Bull. Torrey Bot. Club **6**: 18. 1875.

Nardia Lescurii (Austin) Underwood, Bull. Illinois State Lab. Nat. Hist. **2**: 115. 1884.

Plants growing in more or less dense mats, varying in color from bright green to brownish-green, frequently of a deep rose color. Stems to 4 cm. in length and without the leaves 0.15–0.5 mm. in width, the stems of the fertile plants much wider than those of the sterile plants, the stems of the archegonial plants together with the leaves to 2 mm. in width; older portions of the stem prostrate and adherent to the substratum, the younger parts free from the substratum, sparingly branched, the branches intercalary from lateral segments; terminal branching also present, the branches appearing dichotomous. Rhizoids long, varying from white to light brown, sometimes tinged with claret, usually abundant on the stem to near the apex, mainly in clusters at the base of the amphigastria, frequently also on the ventral base of the leaves and on the ventral side of the stem below the marsupium. Leaves approximate to loosely imbricate, obliquely inserted, not decurrent, spreading from the stem, rarely slightly concave, frequently reflexed on the older parts of the stem, broadly orbicular and frequently somewhat quadrate, often decidedly undulate and crispate, especially on female plants, the dorsal lobe frequently reaching to the middle of the stem or beyond, 0.35–0.9 mm. long and 0.4–1.0 mm. wide, emarginate or emarginate-bilobed, the sinus acute or rounded, frequently gibbose, the lobes rounded, the margin entire, undulate or sinuate. Cells usually with somewhat thickened walls and with large, distinct trigones with bulging sides, the trigones frequently confluent, the walls and trigones often of a deep rose color; median cells rounded to oblong-hexagonal, 24–44 μ wide and 32–56 μ long; marginal cells smaller and subquadrate, 20–33 μ wide and 20–33 μ long; oil-bodies round to oval, frequently bean-shaped, granulate, with uneven outlines, 7–10 μ wide, 10–20 μ long, two to six in each cell, persistent if dried quickly; cuticle smooth or verruculate. Amphigastria constantly present, although sometimes hidden among the rhizoids, standing out from the stem and frequently almost at right angles to it, with the tip incurved, triangular-subulate, the margin entire or with one or more teeth, the amphigastria on the fertile stems usually larger and more ornate than the ones on sterile shoots, entirely free or united at the base for a short distance on one side with the neighboring leaf. Unisexual, both the male and female plants frequently in the same tuft; antheridial bracts commonly in six pairs, frequently as many as fourteen pairs, approximate to more or less closely imbricate, the cluster at first terminal on the main stem, later frequently becoming intercalary by the renewed vegetative growth at the apex of the stem, old stems often showing three or four

distinct zones of antheridial bracts; antheridial bracts emarginate or emarginate-bilobed, the dorsal lobe usually slightly larger than the ventral lobe and more or less deeply saccate and usually less obliquely inserted than the ventral lobe; two or three antheridia in the axil of the dorsal lobe, ellipsoidal to spherical, averaging 0.15 mm. in width and 0.16 mm. in length, the stalk averaging 0.09 mm. in length; antheridial bracteoles constantly present, one for each pair of bracts, similar in size and shape to the amphigastria on the vegetative parts of the stem, usually united at the base for a short distance on one side with the neighboring bract; archegonial receptacle terminal on the main stem; innovations frequently present, sometimes arising between the perianth and the first bract below the perianth, but usually close to the end of the ventral line of attachment of one of the second pair of bracts below the perianth, the innovation sometimes sterile, but usually giving rise to another archegonial receptacle; archegonial bracts in several pairs, larger and more decidedly undulate and crispate than the vegetative leaves and more nearly transversely inserted, otherwise very similar; perianth borne on the upper margin of a small cup-chaped marsupium, in typical plants the longitudinal axis of the mature marsupium nearly at right angles to the longitudinal axis of the stem, mature perianth and marsupium together 1.7–2.0 mm. in length, the perianth and marsupium of about equal length; perianth usually slightly shorter than the archegonial bracts, inflated, entire or irregularly divided into two to four short lobes, the lobes folded together and the mouth dorsi-ventrally compressed into a short, wide beak, the opening usually turned toward the dorsal side of the stem, composed throughout of more or less elongated cells, the cells in the lower part 15–25 μ wide and 40–60 μ long, those at the mouth 13–17 μ wide and 30–45 μ long, the cells, except at the apex, with trigones, the mouth minutely crenulate with projecting cells; bracteole large, variously toothed and frequently 2–3-lobed, free its entire length.

Sporangium oval, very dark brown, 0.65–0.8 mm. long; stalk to 9 mm. long; cell-walls characterized by dark brown thickenings which show on the inner layer of the sporangium wall as transverse bands or half-rings and on the outer wall as knots or lumps; cells of the inner layer average 18 μ in width and 60 μ in length, with five to seven transverse bands or half-rings; cells of the outer layer average 30 μ in width and 37 μ in length, with knot-like thickenings on both the longitudinal and transverse walls; spore-mass reddish-brown; spores round or nearly so, 16–18 μ in diameter, dark yellowish-brown, finely and densely granular-papillate; elaters bispiral, reddish-brown, irregularly bent, slightly attenuate at both ends, the ends obtuse, 8–10 μ in width and up to 105 μ in length.

The following specimens have been examined: OHIO: on wet ledges, cliff-faces, and soil at foot of cliffs, Crane Hollow, Exstein Hollow, Little Rocky Fork, Queer Creek, and Red Rock Ravines in Hocking

County (*Taylor*); on wet ledges, cliff-faces, and moist soil, White's Gulch, Jackson County (*Taylor*). KENTUCKY: on north-facing cliff, Natural Bridge, Powell County (*Lucy Braun*); on sandsoil in cave at same locality (*Margaret Fulford*); on cliff and on soil at foot of cliff at same locality (*Taylor*); on moist bank, Bell County (*Taylor*); McCreary County (*Braun*) (7, p. 120), not examined by the writer. WEST VIRGINIA: on moist sandy bank along stream, near Welch, McDowell County (*Taylor*); Short Mt., Hanging Rock, Hampshire County (*Nelle Ammons 548;* Det. by Dr. A. W. Evans). NORTH CAROLINA: on sandy banks, moist rocks, and soil near waterfalls, Transylvania County (*Taylor*); Macon County (*Taylor*); on sandy banks, Henderson County (*Taylor*); on banks and moist soil, Haywood County (*Taylor*); Buncombe County (*Taylor*); Jackson County (*Taylor*); Avery County (*Taylor*). SOUTH CAROLINA: on wet rocks and banks Oconee County (*Taylor*); on moist soil near spring and on wet ledge, Pickens County (*Taylor*). GEORGIA: on wet rocks, Tallulah Falls, collected by *Lesquereux* in 1850, distributed by Austin in Hep. Bor.-Amer. (No. 5), as *Alicularia Lescurii,* n. sp. (Yale Univ. Herb.); rapids to Mineral Springs (*A. B. Seymour*) (Yale Univ. Herb.); Hurricane Path, vicinity of Tallulah Falls (*Seymour*) (Yale Univ. Herb.); Tallulah Falls (*L. M. Underwood* No. 389), (Yale Univ. Herb.); along Chattooga River, Rabun County (*Taylor*).

In October, 1923, the writer found large mats of a beautiful *Nardia* covering the ledges along a waterfall in Red Rock Ravine, in Hocking County, Ohio. The plants appeared to be unisexual. In April of the following year plants with mature sporophytes were collected. During the latter part of May large numbers of plants with antheridia were examined without finding any trace of archegonia at the tips of the shoots. In June of the same year plants bearing archegonia were collected and these showed no trace of antheridia or antheridial bracts below the terminal archegonial receptacles. Both male and female plants were frequently found in the same tuft. Nearly 1700 plants bearing sex organs have been carefully examined, and in no single case were archegonia and antheridia found on the same plant. The plants were compared with the original specimens of Lesquereux and also with those of Underwood and Seymour, all collected at or near Tallulah Falls and the antheridial plants and young archegonial plants were found to be identical with them. In 1914 Evans (5, p. 89) said that the absence of perianths and capsules in the specimens of *Nardia Lescurii* studied by him, which included both Austin's exsiccatae and a part of Seymour's collection, made it impossible to establish the generic position of the plant beyond all doubt. The material collected by the writer contains both mature perianths and sporangia.

In its typical development *Nardia Lescurii* forms rather dense mats, with the older parts of the stems prostrate and adherent to the substratum and the tips of the shoots somewhat erect. The plants vary in color from light green to brownish-green and frequently are of a deep rose color due to a reddish pigmentation of the cell walls of the leaves and axes. This pigmentation sometimes involves an entire plant but may be restricted to a very small portion of the plant. Distinctly red plants and plants without the reddish pigmentation occur side by side in the same tuft, and frequently the leaves on one side of the stem will be strongly pigmented with red while the leaves on the other side of the axis will be devoid of pigmentation.

Nardia Lescurii grows in very diverse habitats but usually in moist situations. In Ohio it is found in pure growths or with *Diplophyllum apiculatum* and *Calypogeia Sullivantii* at 700 to 800 feet elevation on ledges and faces of cliffs of Blackhand conglomerate in the deep gorges in Hocking County. In Jackson County it grows at about 700 feet elevation on Sharon conglomerate cliffs and ledges along the stream in White's Gulch. At Natural Bridge, Powell County, Kentucky, it occurs on north-facing sandstone cliffs at an elevation of 1,400 to 1,500 feet. The species is very common in western North Carolina on moist sandy banks along roads and streams, on ground near springs, on ledges along waterfalls, on the ground at edge of bogs, and on little hummocks in bogs on some of the high mountains. The writer has collected this species in North Carolina at elevations ranging from 2,000 to 5,000 feet. In Avery, Buncombe, and Macon counties it was found at nearly 4,000 feet, and in Haywood and Jackson counties very fine specimens were collected at nearly 5,000 feet.

Two types of branches are present. In the type more commonly present, the branches are intercalary in character and arise from lateral segments. They originate slightly above the leaf and close to the end of the ventral line of attachment. Branches of this type rarely occur at any considerable distance below the apex of the shoot, but usually originate near the archegonial receptacle, where they develop as innovations. Sometimes the innovation arises between the perianth and the first bract below the perianth, but usually it appears close to the end of the ventral line of attachment of one of the second pair of bracts below the perianth. Innovations almost invariably develop when fertilization fails to take place or when the embryo does not develop. This is particularly apparent in tufts con-

taining plants with sporophytes, where usually no innovations are present on the plants where sporophytes have developed. On the other hand, they are almost invariably present on plants where perianths are present but where no sporophytes have developed. Occasionally two innovations are present. An innovation usually remains sterile for a while, but sometimes it gives rise to an archegonial receptacle after three or four pairs of leaves have been formed. Frequently the innovation remains sterile until it has reached a considerable length. The second type of branching, which is only occasionally present, is terminal in character, and the branches appear dichotomous.

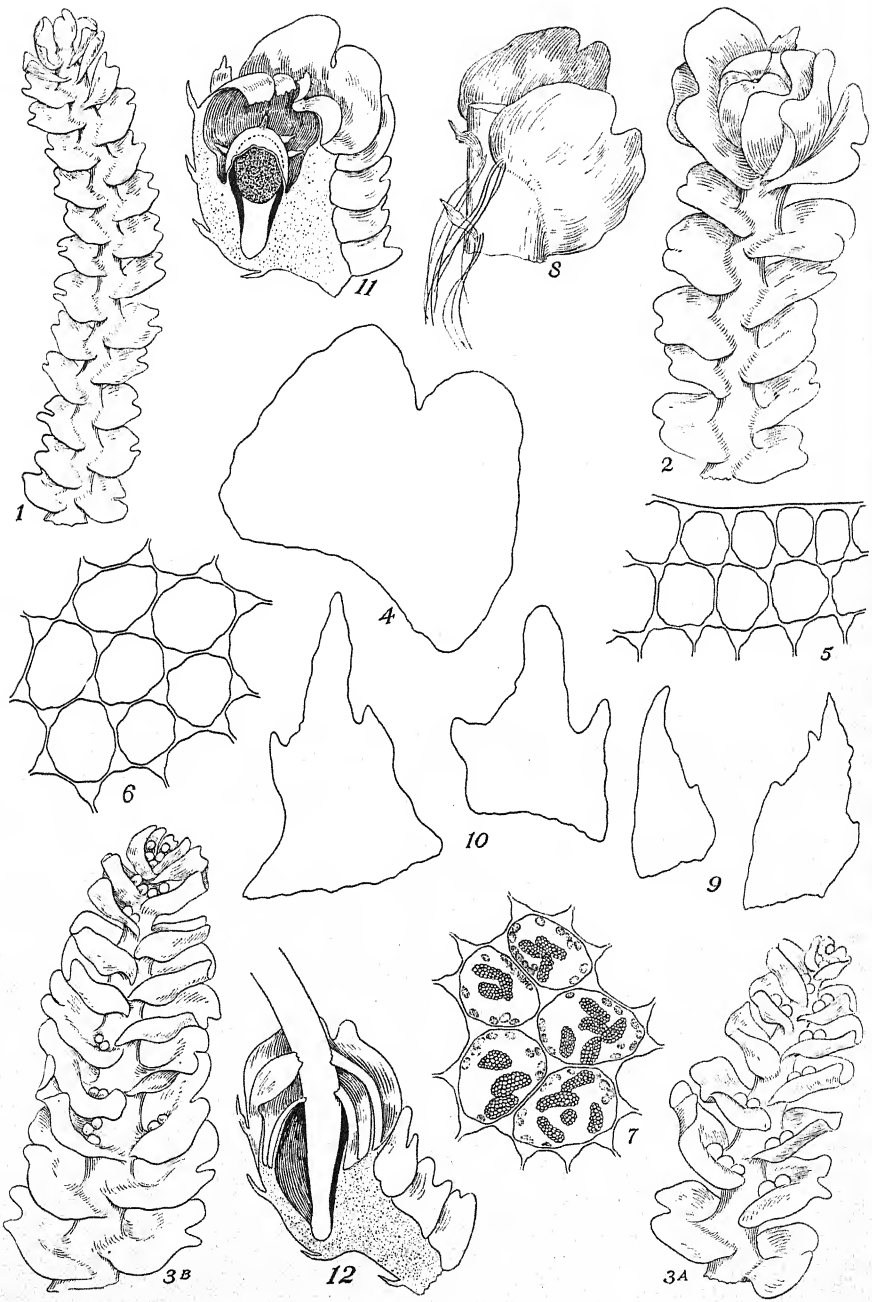
Austin (1, p. 18), in his original description of *Nardia Lescurii*, noted that it differed from *Nardia scalaris* in having all the leaves emarginate or emarginate-bilobed. Underwood (15, p. 115) described the leaves as usually emarginate-bilobed. In all the material of *Nardia Lescurii* examined by the writer, the leaves were found to be emarginate or emarginate-bilobed. The leaves are usually slightly wider than long and frequently are somewhat quadrate. The leaves are obliquely inserted and the dorsal lobe reaches to the middle of the stem or slightly beyond, giving the stem, as seen from above, a zig-zag appearance (Figs. 1, 2). As a rule, the leaves of the sterile plants are plane, but the leaves on the female plants are usually more or less undulate or crispate, these characters becoming increasingly more pronounced the closer the leaves are to the archegonial receptacles (Fig. 2).

EXPLANATION OF FIGURES

NARDIA LESCURII (AUST.) UNDERWOOD

Fig. 1. Part of a sterile plant, dorsal view, × 18. Fig. 2. Part of a female plant showing perianth and archegonial bracts, dorsal view, × 18. Fig. 3a. Tip of a male plant, dorsal view, × 18. Fig. 3b. Tip of another male plant, dorsal view, × 18. Fig. 4. A leaf, × 57. Fig. 5. Cells from the margin of a leaf, × 273. Fig. 6. Cells from the middle of a leaf, × 273. Fig. 7. Cells from the middle of a leaf showing oil-bodies and chloroplasts, × 273. Fig. 8. Section of stem showing position of leaves and amphigastria, lateral view, × 28. Fig. 9. Amphigastria from sterile stem, × 57. Fig. 10. Archegonial bracteoles from different plants, × 57. Fig. 11. Tip of female stem, longitudinally split, showing marsupium, nearly mature sporphyte, "calyptra" with three archegonia containing unfertilized eggs, perianth, two archegonial bracts, three vegetative leaves, two archegonial bracteoles and three amphigastria, × 18. Fig. 12. Tip of female stem, longitudinally split, showing the marsupium, foot and part of the stalk of the mature sporophyte, the torn "calyptra," perianth, archegonial bracts and leaves, × 18.

The figures were all drawn by the writer from material collected in Red Rock Ravine, Hocking County, Ohio.



NARDIA LESCURII (AUST.) UNDERWOOD

The cell-walls vary in thickness but, as a rule, they are decidedly thickened. Trigones are constantly present and are usually very distinct. The trigones frequently have bulging sides and sometimes are confluent. The cell-walls and trigones are often pigmented with red.

In fresh material of *Nardia Lescurii* the oil-bodies are very prominent. Each cell contains two to six of these bodies, which are round or bean-shaped. They are composed of a large number of globular bodies united together, the outline of the whole body being irregular and resembling that of a cluster of grapes (Fig. 7). Incidentally, it was found while working with fresh material that if plants were kept moist and in the dark, the oil-bodies completely disappeared after nine to eleven days. It was also found that the oil-bodies could be preserved in the dried material, if freshly collected plants were dried quickly while exposed to sunlight. This is mentioned merely as one of the interesting things observed in connection with the study of the plant, and is not given as conclusive proof that oil-bodies can always be preserved in this way. Perhaps too little attention has been given to the importance of the oil-bodies as a distinguishing character between genera and between species of the same genus. In the European and North American species of *Nardia*, the oil-bodies play an important part in the taxonomy of the species.

The amphigastria (underleaves) are always well developed and are constantly present on sterile as well as on fertile shoots, although they are frequently hidden among the rhizoids. They stand away from the stem, often almost at right angles to it, and frequently with the tip incurved. The amphigastria are either free their entire length or are united at the base for a short distance on one side with the accompanying leaf. They are triangular-subulate, with the margin entire or with one or more teeth. The amphigastria on the female plants are usually larger and more ornate than those on the sterile shoots.

The antheridial bracts are loosely to closely imbricated and vary from six to fourteen pairs in a cluster. The cluster is at first terminal on a main stem, but often becomes intercalary by the renewed vegetative growth at the apex of the shoot. Old plants frequently show as many as three or four distinct zones of antheridial bracts. The antheridial bracts show considerable variation, not only when different plants are compared, but also when different parts of the same cluster are compared. When dissected off and spread out, the bracts are of

about the same and size and shape as the vegetative leaves. Occasionally the dorsal lobe is smaller than the ventral lobe, but usually it equals or surpasses the ventral lobe in size. The bracts usually present the appearance of being complicate-bilobed, with a slight keel that is rounded in the lower part. The dorsal lobe is more or less deeply saccate, this condition being brought about in part by a dilation of the inner part of the dorsal lobe, in part by an inflexion of the outer part of the dorsal lobe, and in part by a less oblique insertion of the dorsal lobe. Frequently the dorsal lobe shows very little inflexion, this condition being very apparent in the lower bracts of Fig. 3b. On plants recently collected by the writer, all the antheridial bracts were decidedly more complicate-bilobed in appearance and more deeply saccate than the bracts shown in Figs. 3a and 3b. Each bract encloses two or three antheridia. In all cases observed, the antheridia were found only in the axil of the dorsal lobe. The antheridia are ellipsoidal or spherical and average 0.15 mm. in width and 0.16 mm. in length. A number of mature antheridia measured nearly 0.2 mm. in length. The stalk averages 0.09 mm. in length. The antheridial bracteoles are constantly present, and there is a bracteole for each pair of bracts. The bracteoles are very similar in size and shape to the amphigastria on the vegetative parts of the stem, and are usually united in the lower part for a short distance on one side with the neighboring bract.

The female plants are usually larger than the sterile plants and have wider and thicker stems (Fig. 2). The leaves are larger and more undulate and crispate than the leaves on sterile shoots. There is usually no very sharp distinction between the archegonial bracts and the vegetative leaves. The bracts are larger and more decidedly undulate and crispate and are more nearly transversely inserted than are the ordinary leaves, otherwise they are very similar to them. The first two pairs of leaves, and sometimes the third pair of leaves, below the perianth may be designated as the archegonial bracts (Fig. 2). According to many of the descriptions of *Nardia*, the bracts are more or less concrete or coalesced with the perianth. These descriptions do not agree with the actual conditions. The bracts are really borne on the outer surface of a small cup-shaped marsupium, and the perianth is borne on the margin of this marsupium.

It seems appropriate to call attention in this connection to certain distinctions brought out by Knapp (9, p. 88) in an article on the so-

called protective structures associated with the developing sporophytes in the acrogynous Jungermanniales. In the first part of his article, Knapp deals with the structures which represent leaf-like outgrowths of the segments and are homologous to the leaves of the stem. In the second part of the article, he considers the changes which the sporophyte-bearing tip of the stem itself undergoes during the development of the embryo, and describes the structures which are formed around the sporophytes.

In the *Jubula* group of the acrogynous Jungermanniales these structures are derived entirely from the venter of the archegonium and constitute a calyptra in the narrower sense. These conditions are thus exceedingly uniform throughout the *Jubula* group. On the other hand, in the *Jungermannia* group of the acrogynous Jungermanniales, the conditions are far more diverse. It is only in its very youngest stages that the embryo is surrounded only by the venter of the archegonium, and the ensheathing structures are derived in part from tissue at the tip of the stem and in part from the enlarged venter of the archegonium. Knapp emphasizes that the difference in derivation of these structures, which is closely connected with other differences associated with fertilization and the development of the sporophytes, constitutes one of the important distinctions between the two main groups of the acrogynous Jungermanniales. In the *Jubula* group the mature archegonia are almost sessile on the tip of the stem, and the tip of the stem bearing the archegonia does not become very fleshy after fertilization has taken place. After fertilization has taken place, and simultaneously with the enlargement of the venter, a stalk is interpolated between the base of the venter and the stem. In some genera this stalk remains short, but in other genera it becomes relatively long and the venter of the archegonium is correspondingly raised above its original position on the stem. All nutrient materials must pass out of the tip of the stem through this stalk and into the lower part of the venter, where they are diffused through the foot of the embryo. The mature sporophyte is surrounded only by the enlarged venter of the archegonium and is completely enclosed by it.

In the *Jungermannia* group the conditions are very different. After fertilization, not only the venter of the archegonium enlarges but also the archegonial receptacle, and in many species the whole tip of the branch or stem becomes very fleshy. The foot of the young embryo penetrates more or less deeply this fleshy tissue, which is made up, in

large part, of food-storing cells. In 1903 Evans (4, p. 333) called attention to the peculiar enlargement of the tip of the female branch below the perianth in the genus *Odontoschisma*, and said that it was to be considered as one of the secondary effects of fertilization. Goebel (8, p. 109) mentions that one can easily follow the penetration of the sporophyte by the presence of empty, disorganized cells around the lower part of the sporophyte.

Knapp (9, p. 88) distinguishes three main types of growth associated with the sporophyte-bearing tip of the stem during the development of the sporophyte. He further states that, although he has attempted to separate the three types, there is really no very sharp distinction between them. Combinations of any two types and of all three types are to be found.

In the first type described by Knapp (9, p. 88) the whole tip of the stem becomes enlarged and the developing sporophyte penetrates this fleshy tissue. To this type belong the phenomenon of coeocauly and Goebel's *Tylimanthus* type of marsupium. To a certain degree this type is characteristic of the whole *Jungermannia* group. The depth to which the sporophyte penetrates varies considerably in different genera and in different species of the same genus. Commonly only the foot of the sporophyte penetrates the stem tissue, but frequently also the stalk and even the sporangium. Knapp says that coelocauly is actually only the pronounced form of this type of growth, in which even the sporangium penetrates the stem tissue, and the venter of the archegonium is only slightly developed after fertilization has taken place. The part of the stem which the sporophyte penetrates may elongate simultaneously with the penetration of the sporophyte or after the stem has been penetrated, so that the hollowed-out part of the stem does not necessarily represent the actual penetration of the sporophyte. In erect or suberect stems, there is, after fertilization, a more or less uniform growth of the stem on all sides, with the result that the enlargement of the stem and the subsequent sheath-like structure around the sporophyte is more or less symmetrical.

In many horizontally-growing species or species where the female branch is very short, the enlargement of the sporophyte-bearing tip of the stem or branch is not symmetrical, as it is in erect or suberect species, but shows a more or less decided bulging on the side toward the substratum. In some species this ventral enlargement becomes very prominent and forms below the embryo a fleshy protuberance,

into which the developing sporophyte grows. In many species only the foot of the sporophyte grows down into the thickened stem tissue. However, in some species the whole sporophyte penetrates this ventral enlargement. Knapp (9, p. 95) has followed closely the development of the sporophyte-bearing stem in *Prasanthus suecicus* (Gottsche) Lindb., a species in which the foot of the sporophyte penetrates a prominent protuberance on the ventral side of the stem. This species grows closely appressed to the substratum, with the tip of the shoot nearly horizontal. After the archegonia are formed, the longitudinal growth on the ventral side of the stem becomes decidedly more pronounced than the growth on the dorsal side. As a result of this one-sided growth, the whole archegonial receptacle is displaced to the apparent dorsal side of the stem. After fertilization, this unequal growth continues and brings about a further displacement of the embryo and the archegonial receptacle. Vertical growth then brings about the enlargement on the ventral side of the stem into which the sporophyte grows. Knapp says that the development of the sporophyte-bearing tips of the stems in *Nardia geoscypha* (DeNot.) Lindb. and *Nardia Breidleri* (Limpr.) Lindb., two species that usually grow closely appressed to the substratum, is very much the same as in *Prasanthus*. Prominent ventral protuberances are developed on the archegonia-bearing stems in these two species, but are not present on the erect shoot-tips of *Nardia scalaris* (Schrad.) S. F. Gray and *Nardia compressa* (Hook.) S. F. Gray. However, erect forms of *Nardia geoscypha, f. erecta* and *f. suberecta,* show no ventral protuberances on the sporophyte-bearing stems. Knapp designates this type of marsupium as Goebel's *Tylimanthus* type, since it was described by Goebel (8, p. 200) in 1906 for the genus *Tylimanthus*. He further states that this type of marsupium represents a dorsi-ventral modification of the simple penetration of the sporophyte into a radially thickened stem.

In the second type of development described by Knapp (9, p. 99) there is, after fertilization, an increased growth of the stem tissue at the apex of the shoot directly below the archegonia, resulting in a cone-shaped enlargement of the stem inside the perianth. As a result of this growth, the archegonium containing the fertilized egg, together with the archegonia in which fertilization has not occurred, are raised above their original position on the tip of the stem or branch. Instead of standing at the tip of the stem, the archegonia containing unfertil-

ized eggs now appear to be borne on the calyptra or enlarged venter of the archegonium containing the young embryo. Usually, after fertilization has taken place, the stem tissue directly below the archegonia grows upward to only a slight extent, and the archegonia containing unfertilized eggs are found at the base of the venter of the archegonium containing the fertilized egg, and are but slightly raised above their original position on the apex of the stem. In some species, however, the archegonia containing unfertilized eggs are elevated a considerable distance above their original position. The presence, on the sheath directly surrounding the sporophyte, of archegonia containing unfertilized eggs, shows that the sheath is composed, at least in part, of stem tissue.

Instead of using the term calyptra to designate only the enlarged venter of the archegonium, as Goebel does, Knapp suggests that it might be better to designate as calyptra, the whole sheath directly surrounding the sporophyte so far as the sheath extends above the original position of the archegonia. Before fertilization has occurred the mature archegonia and the perianth are borne at approximately the same level on the tip of the stem or branch and later, after fertilization has taken place, the original position of the archegonia can usually be recognized by the insertion of the perianth or, if this is not present, by the insertion of the youngest pair of archegonial bracts. In order to indicate the origin of the different parts of the sheath, Knapp suggests that one may speak of the venter of the archegonium and of the shoot-calyptra. He designates as shoot-calyptra, a sheath directly surrounding the sporophyte, this sheath being derived from stem tissue at the apex of the shoot and bearing on its surface archegonia which contain unfertilized eggs.

Knapp says that there is actually no very sharp distinction between the one process, which in its most pronounced form leads to coelocauly, and the other process, which brings about the formation of a shoot-calyptra. In both coelocauly and the formation of a shoot-calyptra, stem tissue forms to a greater or less degree the sheath directly surrounding the sporophyte. According to Knapp (9, p. 104), the distinction between the two processes is based on this fact, that usually the mature archegonia are borne at the tip of the stem or branch at approximately the same level as the insertion of the perianth or of the youngest pair of archegonial bracts. Knapp then designates as shoot-calyptra the part of the sheath, composed of stem tissue, which ex-

tends above the original position of the archegonia. The part of the sheath below this position he considers as stem tissue penetrated by the sporophyte, and calls the process coelocauly. In coelocauly there is not only a penetration of the stem tissue by the sporophyte, but also an elongation of the stem around the sporophyte. In the formation of a shoot-calyptra, the tip of the stem, on which are borne archegonia containing unfertilized eggs, grows up around the sporophyte, and at the same time the developing sporophyte penetrates the cone-shaped enlargement of the stem apex within the perianth. The main difference between the two processes is based on the fact that in the formation of a shoot-calyptra the penetration of the stem tissue by the sporophyte is slight in comparison with the elongation of the stem tissue around the sporophyte, while in coelocauly the sporophyte penetrates the stem tissue to a considerable distance and the elongation of the stem tissue around the sporophyte is relatively slight.

In the third type of development described by Knapp (9, p. 113) a peripheral zone of stem tissue at the tip of the sporophyte-bearing shoot elongates and grows upward, forming a hollow, cylindrical sheath around the whole group of archegonia, and carries up with it the perianth, if this is present, and also the bracts. To this type belong Goebel's *Isotachis* type and the *Calypogeia* type of marsupia.

The *Isotachis* type of marsupium is developed on erect or suberect tips of shoots and is radial in structure. In 1906 Goebel (8, p. 200) first recognized the morphological significance of this type of marsupium and described it for the genus *Isotachis*. Investigations by Knapp show that this type of marsupium is very pronounced in a number of species belonging to some of our most common genera of hepatics, such as *Marsupella*, *Nardia* (*Alicularia*), and *Plectocolea* (*Eucalyx*). Knapp has followed closely the development of the sporophyte-bearing stems in *Plectocolea hyalina* and *Plectocolea obovata*, two species of a genus closely related to *Nardia*. Formerly these two species were considered by some hepaticologists as belonging to the genus *Nardia*, and by others as belonging to the genus *Eucalyx*. Recently Evans (6, p. 38) has recognized the validity of Mitten's genus *Plectocolea* and has listed under it the new combinations, *Plectocolea hyalina* (Lyell.) Evans and *Plectocolea obovata* (Nees) Evans. In these two species the archegonia are formed at the tip of the main shoot and are enclosed by a young perianth and bracts. The tip of the shoot

consists of meristematic tissue. Through increased growth in a peripheral zone of stem tissue, a hollow, cylindrical sheath grows up around the whole group of archegonia and carries up with it the perianth and the bracts. At the time the archegonia are mature, the perianth is considerably developed and the peripheral zone of stem tissue has grown up a slight distance around the whole group of archegonia. This peripheral zone of stem tissue is meristematic and grows further during the development of the sporophyte. At the same time the perianth and the bracts increase in size and through periclinal divisions become two layers thick at their base. There is, however, no trace of coalescence between the perianth and the bracts. The marsupium developed in these two species is radial in structure.

Knapp (9, p. 118) has followed very closely the development of the marsupium in *Nardia compressa* and *Nardia geoscypha*. The origin of the marsupium in these two species is the same as in *Plectocolea*. In *Nardia compressa*, a species with erect or suberect stems, a marsupium of the *Isotachis* type is formed, the process of development being much the same as that described for *Plectocolea hyalina*. In *Nardia geoscypha*, a species that usually grows closely appressed to the substratum, longitudinal growth becomes greater on the ventral side than on the dorsal side, and growth is at first greater on the under side of the marsupium. As a result of this unequal growth, the whole archegonial receptacle becomes more nearly erect. Later, all parts of the marsupium grow out equally around the archegonia. A peripheral zone of stem tissue grows up around the whole group of archegonia and carries up with it the perianth and the bracts. After fertilization has taken place, a more or less prominent protuberance is formed on the ventral side of the stem below the embryo, and the developing sporophyte grows down into this enlargement of the stem tissue. In *N. geoscypha* the marsupium is a combination of the *Tylimanthus* and *Isotachis* types. That stem tissue also forms part of the "calyptra" in the genus *Nardia*, is shown by the frequent presence on this structure of archegonia containing unfertilized eggs. Thus, all three types of growth associated with the sporophyte-bearing stems of the *Jungermannia* group of the acrogynous Jungermanniales are represented in the genus *Nardia*, and all three types are present in *N. geoscypha*. As previously stated, erect forms of *N. geoscypha, f. erecta* and *f. suberecta*, show no ventral protuberances on the sporophyte-bearing stems. Knapp says that the marsupium in *N. Breidleri* is also a combination of the *Isotachis* and *Tylimanthus* types.

Knapp (9, p. 154) considers the *Calypogeia* type of marsupium a modification of the *Isotachis* type, standing in a similar relation to the dorsiventral development of the archegonia-bearing tip of the shoot as the dorsiventral *Tylimanthus* type represents a modification of the simple penetration of the sporophyte into a radially thickened stem. According to Knapp (9, p. 151), the preliminary requirement for the formation of a marsupium of the *Calypogeia* type is a change in the direction of the shoot axis of about 180°. This change does not take place at the immediate tip of the stem but intercalary on older parts of the archegonia-bearing shoot. After the change of direction has been effected, a peripheral zone of stem tissue grows up around the whole group of archegonia, as in *Isotachis*. Finally, through growth of meristematic tissue below the embryo, the lower tip of the marsupium enlarges, and the developing sporophyte then grows down into this enlargement. In all marsupia of the *Calypogeia* type, the *Tylimanthus* type is also present to some degree. The most important distinction between marsupia of the *Calypogeia* and *Isotachis* types, according to Knapp, is that in the *Calypogeia* type the axis of the little stem is drawn into the marsupium, while in the *Isotachis* type it is not.

So far as the writer has observed, the development of the sporophyte-bearing tip of the stem in *Nardia Lescurii* is very similar to that described by Knapp for *N. geoscypha*. The stems of *N. Lescurii* are usually prostrate, with the older portions closely adherent to the substratum. The archegonia are terminal on the main stem. As a result of the unequal elongation of the dorsal and ventral sides of the apical part of the stem below the archegonial receptacle, and while the archegonia are still in a very young stage, the whole archegonial receptacle is displaced to the apparent dorsal side of the stem. On practically all stems examined, there was a more or less prominent protuberance on the ventral side of the stem below the archegonial receptacle. A peripheral zone of stem tissue grows up around the whole group of archegonia and carries up with it the perianth and the bracts. The mature marsupium is a combination of the *Tylimanthus* and *Isotachis* types. Archegonia containing unfertilized eggs are frequently present on the "calyptra" (Fig. 11). Their presence on the "calyptra" shows that the second type of growth described by Knapp is also present in this species. One finds, then, in *N. Lescurii*, as in *N. geoscypha*, all three types of growth described by Knapp. The longi-

tudinal axis of the sporophyte and of the mature marsupium are frequently nearly at right angles to the longitudinal axis of the main stem (Figs. 11, 12).

Five species of *Nardia* are now recorded for North America and Europe. Four of these species, *N. Breidleri*, *N. compresssa*, *N. geoscypha*, and *N. scalaris*, are found on both continents. At present, the fifth species, *N. Lescurii* is known only from North America, where it has been collected in only a few states in the eastern half of the United States.

Of the four species common to both continents, *N. geoscypha* is the most likely to be confused with *N. Lescurii*. The main distinction between the two species is the difference in sexual character, *N. Lescurii* being constantly unisexual while *N. geoscypha* is constantly paroicous. In addition to the difference in sexual character, which is accompanied with differences in the antheridial bracts and antheridia, *N. Lescurii* is further distinguished from typical forms of *N. geoscypha* by its much larger size, by the presence of emarginate or emarginate-bilobed leaves on all shoots, and by the constant presence of well-developed amphigastria on sterile as well as on fertile shoots. *Nardia geoscypha*, however, exhibits a wide series of variations with respect to size, color, contour of leaves, and habit, all of which are due, perhaps, to differences in habitats. The species has been described under various names, the distinctions having been based largely on variations in the characters just mentioned.

The long list of synonyms cited by Müller (12, p. 517) for *Alicularia geoscypha* is an indication of the extent to which the species has been misunderstood. *Nardia geoscypha* was first described as a species by De Notaris (3, p. 486) in 1859, under the name of *Alicularia geoscyphus*. The apical sinus of the leaves is given as narrowly obtuse or broadly emarginate, or the leaves somewhat bilobed, while other leaves are said to be entire. De Notaris described the species as having no amphigastria. Either he overlooked the antheridia or failed to find them or their remnants, since he writes, "Fructus maturi et antheridia desiderantur" (3, p. 487).

In 1874 Carrington (2, p. 27) published the new combinations, *N. repanda* (Hüben.) Lindb. (based on *J. scalaris* β *repanda* Hüben.) and *N. geoscypha* (De Not.) Lindb. (based on *Alicularia geoscyphus* De Not.). *Nardia repanda* is given as paroicous and the leaves are described as emarginate. Lindberg applied this name to the pale, erect form of

the species. *N. geoscypha* is described as autoicous and the lower leaves are said to be entire or emarginate. Amphigastria are said to be rare on the sterile stems, and the color of the plant is given as reddish-brown or purple.

In 1876 Limpricht (10, p. 251) described the species as *Alicularia minor* and gave as synonyms *Jung. scalaris* β *minor* N. v. E. 1833 and *J. scalaris* β *repandra* Hüben. 1834. The species is described as paroicous and the color of the plant is given as reddish-brown to dark brown, more rarely green. He described the leaves of the sterile shoots as entire, and the leaves of the fertile shoots as having a short, narrow sinus. Amphigastria are said to be evident only on the erect parts of the stem. Limpricht (10, p. 433) states that he is very familiar with both Lindberg's *N. repanda* and *N. geoscypha,* and maintains that both species are paroicous and show such slight differences that he considers them to be merely forms of a single species.

In 1879 Lindberg (11, p. 8) recognized his error in regard to the distinctions he had made between *N. geoscypha* and *N. repanda* (3, p. 27). At the same time he designated the typical form of the species, which he earlier had named *N. geoscypha,* as *N. haematosticta.* He made his earlier *N. repanda* a var. *suberecta* of *Nardia haematosticta.* At the same time, Lindberg described a new species, *N. insecta,* which he gave as paroicous, and the leaves as divided one-fourth to nearly one-half. Amphigastria were said to be present everywhere.

In 1902 Schiffner (13, p. 212) listed the species as *Nardia minor* (N. ab. E.) Arnell. He states that he has never found the species other than paroicous. He describes the emargination of the leaves as extremely variable, and notes that on some sterile shoots one finds scarcely a trace of emargination, while on other shoots one finds as deep a sinus as that given for *Nardia insecta* Lindberg. For this reason Schiffner (13, p. 213) considers *N. insecta* as only a variety of *N. minor.*

As a rule, *Nardia Lescurii* is larger than typical forms of *N. geoscypha,* the stems of the former species averaging 2.5 cm. in length, and commonly attaining a length of 4 cm., while the stems of *N. geoscypha* average from 1 to 1.5 cm. in length. Müller (12, p. 520) states that *Alicularia geoscypha* f. *erecta* Breidl. grows in wet places in tufts 3 to 5 cm. deep, so this form undoubtedly most nearly rivals *N. Lescurii* in respect to size.

The leaves of both sterile and fertile shoots of *N. Lescurii,* so far as

observed by the writer, are always emarginate or emarginate-bilobed. On the sterile shoots of *N. geoscypha* the leaves are frequently entire or only very slightly emarginate and are somewhat concave. The var. *insecta,* which has all the leaves emarginate or emarginate-bilobed, agrees very closely with *N. Lescurii* in this respect. The leaves of *N. geoscypha* are usually smaller than those of *N. Lescurii,* but there is so much variation in this respect that the difference in size of leaves can not be used as a distinguishing character. The leaf-cells are very much alike in both species and the differences in cell-measurements are almost negligible. Moreover, the cells of both species are characterized by the presence of trigones, which are usually very prominent.

Amphigastria are well developed and are constantly present on all shoots of *N. Lescurii.* In *N. geoscypha* they are usually present only at the tip of the fertile stem, but sometimes they are present on the sterile stems. In the var. *insecta* they are present on all shoots. The amphigastria in the two species are very similar in shape, but as a rule they are much better developed in *Nardia Lescurii.*

Although *Nardia Lescurii* and *Nardia geoscypha* bear a strong resemblance to each other and are doubtless closely related, the important distinction in the sexual character of the two species will at once serve to distinguish them. As already noted, *N. Lescurii* is constantly unisexual while *N. geoscypha* is constantly paroicous. This distinction is associated with differences in the antheridial bracts. In *N. geoscypha* the antheridial bracts are in one or two pairs below the archegonial bracts. Except for their position on the stem, there is little to distinguish them from the archegonial bracts, both antheridial and archegonial bracts being more or less decidedly undulate and crispate. Usually, the first pair of bracts below the archegonial receptacle bear no antheridia in their axils and may be regarded as the archegonial bracts. However, in two cases the writer observed antheridia in the axils of the first pair of bracts below the archegonial receptacle. The antheridia are ephemeral and their remnants are difficult to demonstrate. In *N. Lescurii* the antheridial clusters are composed of six to twelve pairs of bracts. Old plants frequently show two or three distinct zones of antheridial bracts. The bracts are usually modified to such an extent that they are readily distinguished from the vegetative leaves. The two lowermost leaves in Fig. 3a are vegetative leaves, while all the leaves in Fig. 3b are to be considered as antheridial

bracts. As previously stated, the writer has recently collected antheridial plants on which all the bracts are decidedly more complicate-bilobed in appearance and more deeply saccate than those shown in Figs. 3a and 3b. In the case of the plants just mentioned the distinction between antheridial bracts and vegetative leaves is decidedly more pronounced than that shown in Fig. 3a. Remnants of the old antheridia can generally be demonstrated in the axils of the bracts long after the contents of the antheridia have been discharged. The conspicuousness of the antheridia led the writer to make measurements of the antheridia in both *N. Lescurii* and *N. geoscypha*. The results were very interesting. In *N. geoscypha* the antheridia, without the stalk, averaged 0.094 mm. in width and 0.10 mm. in length. The largest antheridium measured 0.11 mm. in width and 0.15 mm. in length. The stalk averaged 0.042 mm. in length. In *N. Lescurii* the antheridia averaged 0.15 mm. in width and 0.16 mm. in length. However, many of the antheridia measured 0.198 mm. in length and two antheridia measured 0.20 mm. in length. The stalk averaged 0.09 mm. in length.

Although the sporophyte characters in both species are not constant, they appear to be somewhat more constant in *N. geoscypha* than in *N. Lescurii*. In the latter species the cells of the outer layer of the sporangium wall average 30 μ in width and 37 μ in length. The cells of the inner layer average 18 μ in width and 60 μ in length. The spores average 16.5 μ in diameter, but occasionally a spore is found that measures 18 μ in diameter. In *N. geoscypha* the cells of the outer layer of the sporangium wall average 36 μ in width and 40 μ in length. The cells of the inner layer average 16 μ in width and 75 μ in length. The spores average 19.8 μ in diameter. In both species the spores are granular-papillate. In *N. geoscypha* the average length of the cells of the inner layer of the sporangium wall was rather constant for the different sporangia examined. In *N. Lescurii* the average length of the cells of the inner layer of the sporangium wall varied decidedly not only in sporangia from different localities, but also in sporangia taken from the same tuft.

Identification in the case of both *N. Lescurii* and *N. geoscypha* is simple when the sexual condition of the plants can be determined. However, a positive identification is not always possible in the presence of sterile material of *N. Lescurii* or when dealing with mature female plants when no antheridial plants are present in the tuft. The same

thing is also true of *N. geoscypha* when it is impossible to determine the paroicous condition. In *N. geoscypha* the antheridia are ephemeral. For this reason the antheridia should be looked for while the marsupium and the perianth are still in the very early stages of their development.

There is little danger of confusing *Nardia Breidleri* with *N. Lescurii*. In both species the plants are unisexual and have emarginate or emarginate-bilobed leaves. *Nardia Breidleri*, however, is very much smaller than *N. Lescurii*, the stems being only two or three millimeters in length and forming thick, blackish-brown tufts. Besides this, the areolation of the leaves is decidedly different from that of *N. Lescurii*, the cells, at least in the apical part of the leaf, having equally thickened, reddish-brown walls, while the cell-walls of *N. Lescurii* have very prominent trigones. The cells of *N. Breidleri* are further characterized by the absence of oil-bodies. Prominent oil-bodies are always present in the cells of *N. Lescurii*. Amphigastria are poorly developed in *N. Breidleri* and are present only at the tip of the stem.

Nardia scalaris and *N. compressa* agree with *N. Lescurii* in their unisexual character. In addition to its unisexual character, *N. scalaris* further agrees with *N. Lescurii* in having numerous, lanceolate amphigastria, but it is readily distinguished from the latter species by its entire leaves and by the presence of smooth, shining oil-bodies in the cells of the leaves. In *N. Lescurii* the oil-bodies are composed of a large number of globular bodies united together, the outline of the whole body being irregular and resembling that of a cluster of grapes. *Nardia compressa* is readily distinguished from *N. Lescurii* by its much larger size, the plants being from 4–10 cm. long, and also by the presence of entire, reniform leaves, which are laterally compressed. The oil-bodies are small and sometimes distinct. Amphigastria are scarce except at the apex of the stem or near the archegonial receptacles.

The writer wishes to acknowledge the kindness of all who have loaned specimens for study or have given assistance in any way, and would express her sincere thanks to Prof. J. H. Schaffner, Dr. A. W. Evans, and Dr. G. W. Blaydes for their helpful suggestions during the preparation of this paper.

ASHEVILLE, NORTH CAROLINA

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THE ANNULUS OF POTTIA TRUNCATA (HEDW.) FÜRNR.*

R. T. WAREHAM AND JOHN B. WHITNEY, JR.†

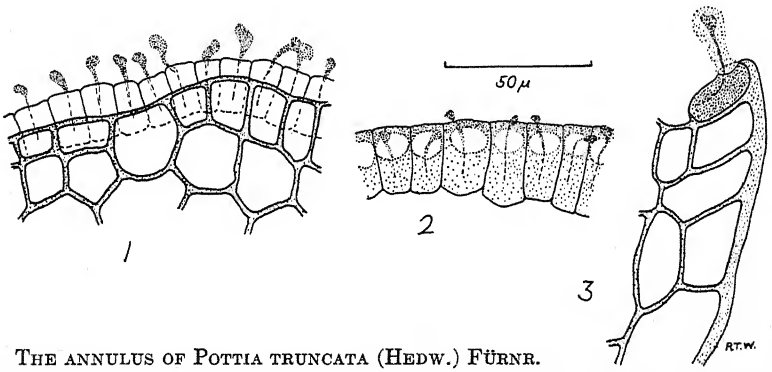
In the course of a recent study of the *Pottiae* of North America (4) the annulus of *P. truncata* was found to be markedly different from that of the others in that a minute, colorless, club- or hook-shaped filament extended from each annular cell. These peculiar structures prompted further study of the annulus. The observations to date are here reported.

Viewed from the outside of the capsule, the filaments extend above the mouth of the urn (Fig. 1). Seen from above, the annulus cells

* Papers from the Department of Botany, The Ohio State University, No. 415.

† The anatomical study was carried out by R. T. Wareham; the microchemical study by John B. Whitney, Jr.

are elongated and appear to have a circular opening or pore at the outer end on the upper face. The filaments extend upward from this pore (Fig. 2). From a longitudinal-radial view, the point of attachment and relation of the filaments to the annulus cells can be seen more clearly. The lower end of the thread-like filament extends from near the inner end of the cell through the pore (Fig. 3). A very transparent slime or mucilage surrounds the filaments. When stained with aqueous Bismark Brown, the filaments are deeply stained, while the slime, though definitely stained, remains lighter in color. That the origin of the slime and filaments is within the annulus cells is indicated



THE ANNULUS OF POTTIA TRUNCATA (HEDW.) FÜRNR.

Fig. 1. Portion of deoperculate urn mouth seen from the outside. Fig. 2. Upper surface of annulus. Fig. 3. Longitudinal-radial section through the urn mouth. All figures 380: 1; made with the aid of a camera lucida.

by its association with the pore (Fig. 3). Further, the filaments have been seen emerging from the cells when dry capsules were moistened under microscopic examination. In making the microchemical determinations the procedures discussed in Tunman (3) were followed.

Ruthenium Red stains the untreated filaments and slime, suggesting the presence of pectic materials. Iodine or chlorozinc-iodide colors the unswelled material yellow, and colors it blue after swelling with dilute KOH, indicating the presence of hemicellulose. The filaments and slime do not dissolve in water, indicating that pectin is not the major pectic component. Cold dilute KOH does not dissolve nor swell the filaments. Hot dilute KOH swells them but does not dissolve them, indicating that pectic acid is not the chief constituent. Cold dilute H_2SO_4 or HCl, alone or followed by dilute KOH, does not

dissolve the filaments and slime, suggesting that calcium pectate is not the chief constituent. Hot dilute HCl or H_2SO_4 does dissolve the filaments and slime, indicating that they are composed of pectose (protopectin) or hemicellulose or both. The unswelled filaments are isotropic; when swelled with KOH they are faintly anisotropic, suggesting the presence of hemicelluloses (2, p. 129). This conclusion is borne out by the staining reaction with iodine and chlorozinc-iodide.

The indications are, therefore, that the filaments and slime are composed of pectose (protopectin) and hemicellulose. Tunman (3, p. 921), notes that hemicelluloses are not a distinct group but are included with pectic substances by many investigators.

Lorch (1, p. 240–241) describes "Schwellkörper" in a description of the annulus of *Bryum pseudotriquetrum* Schwägr. The chemical tests he cites, while not critical, indicate the possibility of the presence of hemicellulose and do not preclude the possibility of the presence of pectic substances. The "Schwellkörper" of *B. pseudotriquetrum* may be homologous with the annular filaments of *P. truncata.*

The slime and filaments may function in lifting the operculum from the urn. The filaments may be seen most easily by removing, under water, the operculum from the well-moistened capsule. The annulus of *P. intermedia* (Turn.) Fürnr. is identical with that of *P. truncata,* further evidence of their very close relationship. In *P. lanceolata* (Hedw.) C. Müll. similar structures occur, but the filaments are shorter and not so well defined.

THE OHIO STATE UNIVERSITY
COLUMBUS, OHIO

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A NEW SPECIES OF LICHEN FROM NORTH CAROLINA

ALBERT W. HERRE

Among the numerous puzzling and more or less aberrant lichens received from Mr. G. G. Nearing, of Ridgewood, New Jersey, is an interesting specimen of an *Anthracothecium* which I am reluctantly compelled to describe as new.

ANTHRACOTHECIUM **pauciloculare** Herre, sp. nov.

Thallus epiphloedes, sat crassus, laevis, flavido-cinerascens, hypothallo nigricante limitatus. KOH — . Apothecia crebra; perithecium globosum, semi-immersum, nigricans, parte emersa hemisphaerica, ostiolo parum conspicuo. Asci subcylindrici; paraphyses simplices. Sporae octonae, fumoso-olivaceae, obliquae verticaliter uniseriatae, plerumque quadriloculares, oblongae, apicibus rotundatis, septis transversis 3–5, loculis lenticularibus; crass. 14–20 μ, et long. 24–39 μ.

Ad corticem arboris, Kitty Hawk, North Carolina.

The thallus is uniform, dull yellowish-dusky ashen in color, with a black limiting hypothallus; KOH — . The numerous apothecia are more or less clustered. The perithecium is globose, more or less immersed, black, the emergent portion hemispherical, the ostiole little or not at all visible. The asci are more or less cylindrical, the paraphyses simple. The eight spores are arranged obliquely in a vertical row, smoky to smoky-brown, and oblong with rounded ends. Most of them are quadrilocular, only a few showing more than one row of cells or more than three septae; breadth 14–20 μ, length 24–39 μ.

Type specimen collected on the bark of trees at Kitty Hawk, North Carolina.

STANFORD UNIVERSITY, CALIFORNIA

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UNIVERSITY OF CINCINNATI

A NEW RECORD OF FISSIDENS SUBLIMBATUS

WILLIAM B. DREW

According to the most accurate information which the writer has been able to obtain, *Fissidens sublimbatus* Grout has been collected previously but four times, all from stations in Arizona (*Type*, E. B. Bartram, no. 1613) and New Mexico.[1]

It was therefore interesting to discover this moss among the collections from Missouri made by the writer[2] during 1937–1938 while he was a visiting Assistant Professor of Botany at the University of Missouri. Two separate collections of the species were made from a locality a few miles south of Columbia, Boone County. One of these stations is on the wet, shaded limestone cliff forming what is locally known as the "Rock Bridge" (W. B. Drew, no. 18038, June 26, 1938). The second station is nearby on the cool, wet mossy sides of a sinkhole known locally by the picturesque name of "The Devil's Ice Box" (W. B. Drew, no. 21138, June 26, 1938).

According to Dr. Grout, who has very kindly checked the writer's determination, the Missouri plants differ somewhat from the type in having more acute leaves with the cells not so regularly arranged. Moreover, the operculum appears to be larger than that of the type; but as Dr. Grout has pointed out to the writer (*in litt.*), this circumstance may well be due to immaturity. Since the species is so little known, it is not surprising to find that additional collections manifest variations from the typical; but until more material of *Fissidens sublimbatus* accumulates, it will not be possible to establish exactly the limits of variation.

DEPARTMENT OF BOTANY,
CARLETON COLLEGE, NORTHFIELD, MINNESOTA.

NOTE

From August 20, 1939, to June 1, 1940, the address of the Editor will be: Department of Biology, University of Puerto Rico, Río Piedras, Puerto Rico. To this address should be sent all contributions for THE BRYOLOGIST.

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[1] See Grout, A. J., Moss Flora of North America 1: 14. 1936.

[2] This note is the first in a projected series of reports on the bryophytes of Missouri, the investigation of which was greatly enhanced by a grant made by the University of Missouri Research Council to which the writer hereby makes grateful acknowledgement.

Volume 42, Number 3, including pages 53–84, was issued June 1, 1939.

THE HEPATIC EXCHANGE CLUB

Beginning January 1, 1939, this Club has been operated under the same rules as The Moss Exchange Club. Privileges are available only to members of the Sullivant Moss Society who have paid annual dues of 25 cents to Dr. A. J. Sharp, Department of Botany, University of Tennessee, Knoxville, Tennessee. Only fully determined specimens in packets with complete data will be accepted. It is suggested that there be at least five packets of each species with an extra which will be forwarded to the Curator of Hepatics for the Sullivant Moss Society Hepatic Herbarium. All material for determination should be sent to the Curator of Hepatics, Dr. Margaret Fulford, Department of Botany, University of Cincinnati, Cincinnati, Ohio.

THE MOSS EXCHANGE CLUB

As announced in The Bryologist 38: 100, Sept.-Oct., 1935, there is now an exchange club for mosses. This exchange is available to members of the Sullivant Moss Society upon payment of annual dues of 25 cents to Mrs. Inez M. Hasing, Woodland, Ulster Co., N. Y. Only fully identified specimens in packets with complete data on them should be sent in. It is suggested that there be five or more packets of each species.

These two exchanges offer an excellent opportunity for S.M.S. members to build up their own herbaria of choice, well-labelled specimens.

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CONTENTS

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Address all specimens for identification directly to the Curator concerned.

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A NEW SPECIES OF PLAGIOCHILA FROM THE SOUTHERN APPALACHIAN MOUNTAINS

H. L. BLOMQUIST

IN 1896, Evans published his *Notes on the North American Species of Plagiochila.*[1] In this paper eight species are discussed, three of which are described as new. Later he found one of these (*P. Sullivantii* Gottsche) to be an aggregate of two species from which *P. Austini* Evans was segregated.[2] Since that time four new species (*P. alaskana* Evans, *P. arctica* Bryhn and Kaal., *P. Fryei* Evans, *P. Smallii* Evans) have been described and the European species *P. tridenticulata* (Hook.) Taylor has been found in this country. With the transfer of one species (*P. interrupta* (Nees.) Dumort) to the genus *Pedinophyllum* Lindb., thirteen species are now recognized for North America north of Mexico and the West Indies.

In the autumn of 1937, among some specimens of Hepaticae collected by Lewis E. Anderson in western North Carolina, the writer found a *Plagiochila* characterized by conspicuously irregularly divided leaves with caducous lobes. The uncommonness of these characters indicated an undescribed species and this opinion was later confirmed by Dr. Evans.

Some time later, A. J. Sharp informed the writer that he had collected similar material in several localities in eastern Tennessee. Both Anderson and Sharp then suggested that the writer describe the new species and kindly offered to place all their collections at his disposal.

[1] Bot. Gaz. **21**: 185–194. 1896.
[2] Rhodora **16**: 68–70. 1914.

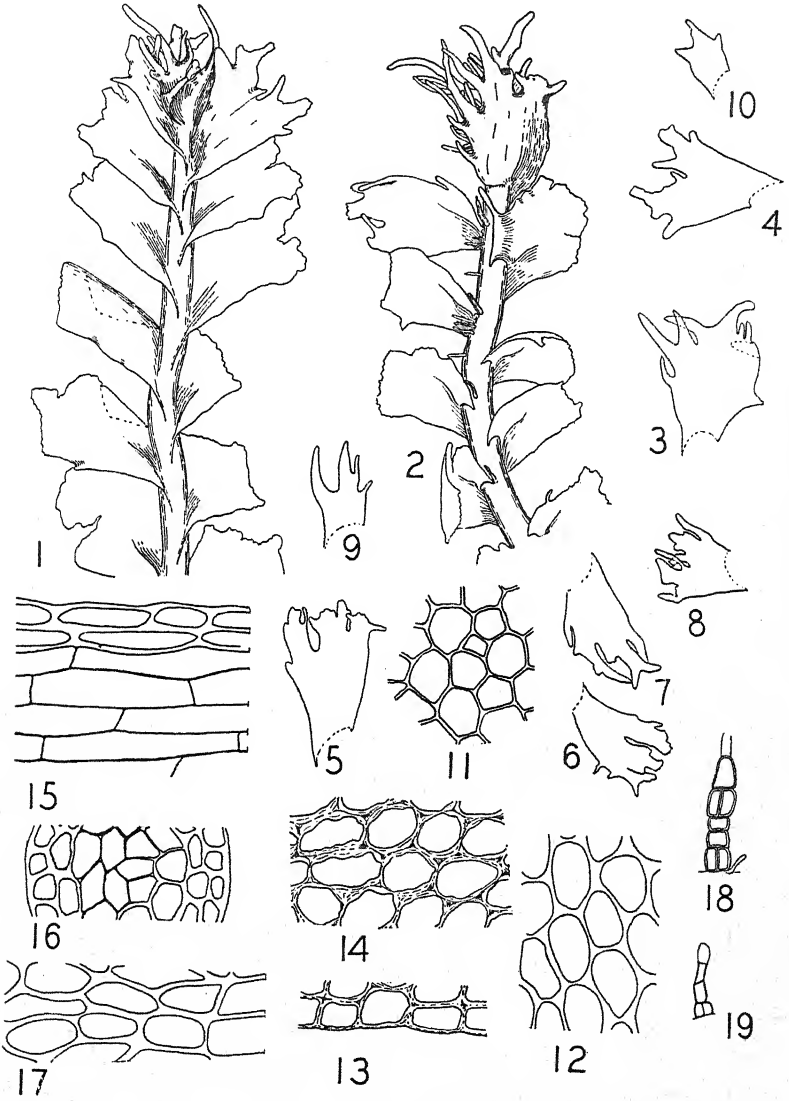
PLAGIOCHILA **caduciloba** sp. nov.

Planta rubro-fusca (raro virido-fusca), repens, intricata. Caulis diffusus vel subascendens, fragilis, parce inaequaliterque vel subdichotome ramificatus, longus circa 2 cm., crassus .12–.18 mm., compositus e duabus laminis cellularum parietibus incrassatis directiangularum vel oblongarum cingentium cylindrum cellularum parietibus tenuibus elongatarum. Folia caulina alterna, distantia, diffundentia 45°–70°, late cuneata, circa 1 mm. longa et lata .5 mm., longe decurrentia in dorso sed breviter in ventriculo; margo dorsalis recta vel leviter undulata aliquando lobum havet, dum margo ventralis nonnumquam leviter retroversa unum, duos, vel tres lobos saepenumero habet; apex latus ferens tres vel duos lobos primarios qui idem in lobos caducos inaequaliter dividuntur. Folia ramea similia foliis caulinis sed plerumque minora, lobis primariis vix aut omnino non divisis. Cellulae foliorum 21–25 μ prope apicem, 15–28 μ ad basim, trigonis distinctis. Amphigastria male maturantur. Inflorescentiae non visae sunt.

Plant light to reddish-brown, rarely dark green, growing in depressed mats. Stem spreading to slightly ascending, brittle, sparingly irregularly branched or sub-dichotomous, 2 cm. or more in length .12 to .18 mm. in diameter, composed of 2 layers of thick-walled rectangular or oblong cells surrounding a central cylinder of thin-walled elongated cells; short rhizoids occasionally present. Stem leaves alternate, distant, spreading at an angle of 45 to 70 degrees, slightly convex, broadly cuneate, about 1 mm. long by .5 mm. wide at the widest part, moderately long decurrent antically, short decurrent postically; antical margin straight to slightly undulate, often with a single narrow lobe, rarely more; postical margin the same as the antical but more often with one to three or more lobes, sometimes slightly broadly revolute; apex broad, commonly with 3 or 2 primary lobes, the lobes deeply irregularly dissected into finger-like, blunt to acute caducous secondary lobes which often obscure the primary lobing. Branch leaves similar to the stem leaves but usually smaller and having the 3 or 2 primary lobes little if at all divided. Leaf cells averaging 21 to 25 μ near the apex and 25 to 28 μ at the base; trigones distinct except near the apex. Amphigastria rudimentary. Inflorescences not seen. Sharp's specimen no. 3871 is designated as the type and is deposited in the Herbarium of Duke University; a duplicate of the type is in the Herbarium of the University of Tennessee.

NORTH CAROLINA: moist rocks, Bearwallow Falls, Toxaway Gorge, Transylvania Co., Anderson 4295.

TENNESSEE: conglomerate cliff, Bullhead, Mt. LeConte, Sevier Co., Sharp 341028; moist rock, Pinnacle Mt., Trail, Greenbrier, Sevier Co., Sharp 341101; moist shaded cliffs, Spruce Flats Branch, Tremont, Blount Co., Sharp 34205, 34603; moist face of bluff, Greenbrier, Sevier Co., Sharp 3871.



FIGS. 1–19. PLAGIOCHILA CADUCILOBA Blomquist. 1, 2. Upper and lower sides respectively of main shoot, × 90. 3–8. Stem leaves showing variation in lobing, × 90. 9, 10. Branch leaves, × 90. 11. Cells from near apex of leaf, × 900. 12. Cells from base of leaf, × 900. 13. Cells from leaf margin, × 900. 14. Median leaf cells, showing trigones and undulate walls, × 900. 15. Cells in longitudinal section of stem, × 900. 16. Cells in cross section of stem, × 900. 17. Cells from surface of stem in optical view, × 900. 18, 19. Amphigastria, × 667.

The most outstanding characteristics of this interesting species are the much divided leaf apices and the early shedding of the lobes (Figs. 1, 2). So far as is known, no other species of *Plagiochila* has the combination of these two features developed to such a degree. In fact the extreme lobing and the early falling of the lobes have made it somewhat difficult to determine the fundamental shape of the leaf. This has only been possible through a study of the younger leaves at the tip of the plant and of the leaves of the smaller branches (Figs. 9, 10) in which the fundamental lobing is often not obscured by further division and the lobes remain more or less intact. The secondary lobing at the apex of the leaves is so variable that no two leaves are exactly the same. The presence of lobes on the postical and antical margins is a fairly constant feature but the number and position of these lobes also vary. The antical margin has commonly fewer lobes than the postical.

The stem is usually sparingly branched, but when branching is present it is apparently dichotomous or at least suggests dichotomy. Intercalary branching is quite frequent.

Leaf cells also vary in size and shape, especially in the median portion of the leaf, ranging from small, almost isodiametric, to relatively large and oblong. The walls are usually smooth but in some leaves, especially in the older ones, the cell walls may become thick, undulate, and distinctly lamellate (Fig. 14). Trigones are quite distinct at the base of the leaf but become less so towards the apex.

While regeneration of the caducous lobes has not been observed in this species, it seems safe to assume that they function as propagules in vegetative reproduction, as has been observed in other species.[1] The structures involved in vegetative reproduction of liverworts have been recently ably discussed by Degenkolbe.[2] According to his classification the caducous lobes of the new species would come under the term "Bruchblätter."

According to the most recent revision of the genus *Plagiochila* by Carl,[3] the new species falls in the Section *Bidentes* of the Subgenus *Eu-Plagiochila*. This section is characterized by small species with capillary, brittle stems and small leaves, usually not over 1 mm. in length. The leaves are relatively far apart and form a broad angle

[1] Carl, H. Hedwigia **72**: 148–155. 1932.
[2] Ann. Bryol. **10**: 43–96. 1937.
[3] Ann. Bryol., Suppl. II, 170 pp. 1931.

with the stem and often show a tendency to drop off. The tip is usually 2, 3 or rarely more divided. The leaf cells are usually relatively large, thin-walled, and with or without trigones. The amphigastria are much reduced, ranging from a few to several cells.

According to Carl (pp. 47–48), the species which belong to the section *Bidentes* include the following: *P. bidens* Gottsche, *P. bicuspidata* Gottsche, *P. cuneata* Gottsche, *P. trifida* St., *P. loriloba* Herzog (recently reduced to a variety of *P. cuneata* by Herzog), and *P. tridenticulata* (Hook.) Dumort. Three of these species (*P. bicuspidata, P. cuneata,* and *P. tridenticulata*) occur in North America.

In attempting to work out the relationship of the new species some difficulty has been encountered in obtaining authentic specimens. However, from the specimens available and with the help of the original descriptions and illustrations, it seems fairly safe to conclude that the new species is most closely related to the Mexican species *P. cuneata.*[1] This has deeply 2–3-lobed leaves and the lobes are often further variously shallowly lobed. *P. cuneata* does not, however, show a strong irregularity in secondary lobing nor any extreme tendency to an early shedding of the lobes. However, according to Degenkolbe[2] the leaves of this species as well as of some others readily break up into fragments.

The nearest relative of the new species in geographical distribution is *P. tridenticulata* which occurs at high altitudes in the southern Appalachian Mountains. This species has 2–3-lobed leaves but does not show any marked tendency to secondary lobing nor the caducous habit of the lobes, although whole leaves often drop off. There is, however, some similarity between the branch leaves of the new species (Fig. 10) and the stem leaves of *P. tridenticulata.* The leaf cells of both species are also quite similar although those of the latter are on the average smaller.

The writer wishes to express his appreciation to Lewis E. Anderson and A. J. Sharp for placing their collections at his disposal, to Alexander W. Evans for his kindness in reading the manuscript and offering valuable criticisms and helpful suggestions, and to R. R. Roseborough of Duke University for his assistance in preparing the Latin diagnosis.

DEPARTMENT OF BOTANY,
DUKE UNIVERSITY, DURHAM, N. C.

[1] Gottsche, C. M. De Mexikanske Levermosser. Pp. 137–139. Tab. IV. 1867.
[2] *Loc. cit.*, p. 49.

FIELD NOTES ON A COLLECTION OF LOUISIANA HEPATICAE

RUTH DOWELL SVIHLA

DURING the years 1925 to 1927, as opportunity permitted, hepatics were collected in the marsh region of southern Louisiana by Ruth and Arthur Svihla. These were sent to Miss C. C. Haynes who, together with Dr. M. A. Howe, identified them. I am indebted to Miss Haynes for permission to report on this small collection at this time.

Most of the collecting was done south of Morgan City which lies about a hundred miles west of New Orleans on the Atchafalaya River. This whole region is a vast prairie of tidal marshes which are inundated most of the time with more or less brackish water. During very high tides or storms blowing in from the gulf, the water becomes quite saline while during the spring, the river brings down fresh flood waters from the north. The vegetation consists chiefly of grasses and sedges among which are *Phragmites communis*, the "roseau," which is the dominant species; *Scirpus robustus*, the three-cornered grass; *Panicum hemitomum*, *Spartina patens* var. *juncea* and *S. cynosuroides*, the "paille fine" grasses; and *Typha angustifolia* and *T. latifolia*, the cattails. These marshes incidentally form the habitat of the southern muskrat, *Ondatra rivalicia*, which occurs here in great numbers. Intersecting the marsh proper are numerous bayous which form a regular labyrinth separating the many islands. Many of the bayou banks are levees and so are higher and drier than the periodically inundated marsh land. Dotted here and there over the flat landscape are "tree islands" consisting of clumps of trees varying in size and including among others willows, live oaks, gums and cypresses. Hepatics were common on these tree islands, along the bayou banks, and in the sugar cane fields. What was lacking in diversity of species was made up in quantity for many of the trees were festooned with both hepatics and mosses which often grew so intermingled as to make separation difficult. The majority of specimens were collected on Avoca Island, which is a shallow, saucer-shaped island more or less artificially drained for agriculture. Sugar cane fields occupy part of the island although most of it is overgrown tree island vegetation and partially drained marsh. The other islands, on which collecting was done, consisted of marsh land and tree islands. Slidell, where *Odontoschisma prostratum* (Sw.) Trev. was taken, is north of the marsh region in the

eastern part of the state. Here piney woods form the dominant vegetation and the country is decidedly high and dry compared with the marshes.

In the following list, those specimens which are the first definitely published records for Louisiana, as far as I have been able to ascertain, are starred:

ANTHOCEROS LAEVIS L. Avoca Island, Côte Blanche, Morgan City.

ANTHOCEROS PUNCTATUS L. Avoca Island, Cow Island, Bateman's Island, Morgan City.

ASTERELLA TENELLA (L.) Beauv. Thibideaux.

CEPHALOZIELLA sp. (sterile) Morgan City.

COLOLEJEUNEA MINUTISSIMA (Sm.) Schiffn. Avoca Island, Bateman's Island.

*COLOLEJEUNEA SETILOBA Evans. Avoca Island. Nearest locality record is Florida.

EUOSMOLEJEUNEA DURIUSCULA (Nees) Evans. Avoca Island.

FOSSOMBRONIA sp. (immature). Cow Island, Morgan City.

FRULLANIA INFLATA L. and L. Avoca Island, Bateman's Island, Sword Bayou.

*FRULLANIA KUNZEI L. and L. Avoca Island, Bateman's Island. Known from other southern states.

*FRULLANIA OBCORDATA L. and L. Avoca Island, Sword Bayou, Bateman's Island, Bayou Chêne. Widely distributed in tropical America, and recorded from Florida to Louisiana.

*FRULLANIA SQUARROSA (R., Bl. & N.) Dum. Avoca Island, Houma, Morgan City. Widely distributed in tropical regions. Recorded from Connecticut to Ohio, south to Florida and Louisiana; Bermuda.

*LEJEUNEA FLAVA (Sw.) Nees. Avoca Island, Bateman's Island, Houma, Morgan City. Recorded from Florida to Texas.

*LEJEUNEA GLAUCESCENS Gottsche. Avoca Island, Bateman's Island. Widely distributed in tropical America. Reported from Florida, Bahamas and the West Indies.

*LEJEUNEA MINUTILOBA Evans. Avoca Island. Recorded from Bermuda, Cuba, Porto Rico, and St. Thomas by Evans who described this as a new species stating "it is to be expected in Florida and Mexico" (Bull. Torr. Bot. Club **44**: 525–527, 1917). However I fail to find it in "A preliminary Check List of the Hepaticae of Europe and America (north of Mexico)" (Buch, Evans and Verdoorn in Annales Bry-

ologici, **10** (1937): 3–8, 1938). This then seems to be the first published record for this hepatic in the United States.

*LEJEUNEA SPINILOBA Lndnb. & Gottsche. Bateman's Island. Known from Florida, Mexico and the West Indies.

*LEPTOCOLEA CARDIOCARPA (Mt.) Evans. (*L. cardiocarpa* (Warnst.) Evs.) Avoca Island. Recorded from Florida, Georgia and North Carolina.

*LEUCOLEJEUNEA CONCHIFOLIA Evans. Avoca Island. Known from South Carolina, North Carolina, Alabama, Georgia and Florida.

LEUCOLEJEUNEA UNCILOBA (Lndnb.) Evans. Avoca Island, Bayou Chêne, Morgan City, Bateman's Island.

MICROLEJEUNEA LAETEVIRENS (N. & M.) Evans. Avoca Island, Bateman's Island.

*MICROLEJEUNEA RUTHII Evans. Avoca Island. Known from Tennessee, Ohio, West Virginia and Kentucky.

*NOTOTHYLAS ORBICULARIS (Schwein.) Sulliv. Morgan City. Known to occur in North America from Canada to the Gulf of Mexico.

*ODONTOSCHISMA PROSTRATUM (Swartz.) Trev. Slidell. Known from temperate and tropical North America.

*PTYCHOCOLEUS HETEROPHYLLUS Evans. Bateman's Island. Known from Florida and Honduras.

*PALLAVICINIA LYELLII (Hook.) S. F. Gray. Avoca Island. Known from Canada to tropical America.

PORELLA PINNATA L. Avoca Island, Bateman's Island, Morgan City, Sword Bayou.

RADULA CALOOSIENSIS Aust. Avoca Island, Bateman's Island, Morgan City.

RICCARDIA PINGUIS (L.) Gray. Avoca Island, Duck Lake, Houma, Morgan City, Bateman's Island.

*RICCARDIA SINUATA (Dicks). Trev. (*R. major* (Nees) Lindb.) Avoca Island. Widely distributed in North America.

*RICCIA AUSTINI Steph. Côte Blanche. Widely distributed in North America.

RICCIA FLUITANS L. Avoca Island, Houma, Paradis.

RICCIOCARPUS NATANS (L.) Corda. Avoca Island, Bayou Chêne, Morgan City.

*SPHAEROCARPUS DONNELLII Aust. Cameron, Côte Blanche. Known from Florida and Georgia.

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON

THE DEVELOPMENT OF GEMMAE IN METZGERIA MYRIOPODA[1]

RUTH OLIVE SCHORNHERST

IN northern Florida, where conditions are favorable for growth practically the year round, many liverworts seem to reproduce year after year only by vegetative means. In watching *Metzgeria myriopoda* Lindb. over a period of ten years, I have seen no sporophytes but the thalli at all seasons have abundant gemmae. This study was originally undertaken merely to determine the origin and development of these vegetative bodies; but since they are of taxonomic significance a comparison with those of *Metzgeria uncigera* Evans, the only other species found in this region, may not be amiss. The latter species is apparently rare, for it has been collected from only one place in northern Florida (2), but *Metzgeria myriopoda* is more or less abundant.

Metzgeria myriopoda has been collected from the Alleghany Mountains by Sullivant and Gray, from Tennessee by Fredrickson, from New Orleans by Drummond, and has also been reported from Brazil and Argentina. It is apparently common throughout the Gulf coastal region. The material from which these studies were made was collected near Tallahassee, Florida, during the months of September–May of various years from 1927 to 1938. Material was preserved in the field in fifty per cent alcohol and then mounted in ten per cent glycerin. The thalli are so delicate that stronger concentrations cause rapid disintegration. Miss Faith Pennebaker of Tulane University kindly furnished gemmiparous material of *Metzgeria uncigera* collected near Ocean Springs, Mississippi, from which Fig. 13 was made.

Metzgeria myriopoda was first described by Lindberg (3) in 1874. He stated that gemmae came from the margins of the thalli, thus multiplying the species. Different types of gemmae were referred by him to different species but he did not emphasize this fact. Evans (1) states that gemmae show great variety in form and structure and that many of their peculiarities are specific in character and often afford a convenient means of distinguishing between closely related plants.

[1] The detailed study of the origin and development of gemmae on *Metzgeria myriopoda* was made at the suggestion of Dr. W. J. G. Land of the Botany Department of the University of Chicago. I wish to take this opportunity to express my appreciation to Dr. Land for his help and inspiration; to Dr. Herman Kurz, Florida State College for Women, for excellent suggestions and aid in collecting some of the material used; and to Dr. A. W. Evans of Yale University for valuable suggestions and criticisms of this paper.

He calls attention to the different types of gemmae on *Metzgeria uncigera* and *M. myriopoda*. The gemmae of these two species differ little in shape and size; but those of the former possess numerous marginal hairs which are hooked at the apex (Fig. 13), while those of the latter are shorter and straight (Figs. 10, 11). Evans also states (page 274) that the gemmae of *Metzgeria uncigera* "often become crowded in the apical region of a branch," and shows in his Fig. 1 the apex of a gemmiparous branch bearing gemmae in both marginal and apical positions. In *Metzgeria myriopoda* the gemmae appear scattered along the margins of the thallus but never at the tip in the apical region so far as observed. A full description of *Metzgeria uncigera* may be found in Evan's paper referred to above.

Species producing thalloid gemmae often grow in places where it is difficult for the young plants to develop, such as on tree trunks or on rocks. *Metzgeria myriopoda* grows in mats on the lower part of tree trunks in rather moist places. The thallus averages twenty-two cells in width, and excepting the midrib is a ribbon one cell in thickness. The midrib is two or three cells wide and from five to eight cells thick; the cells of this midrib differ slightly from the others of the thallus, being somewhat elongated and having denser contents. Evans states that the gemmae are produced on special gemmiparous branches which are a little narrower than the usual thallus but are otherwise little differentiated. So far as I have been able to tell, they may be produced on almost any thallus as well as on these specialized branches.

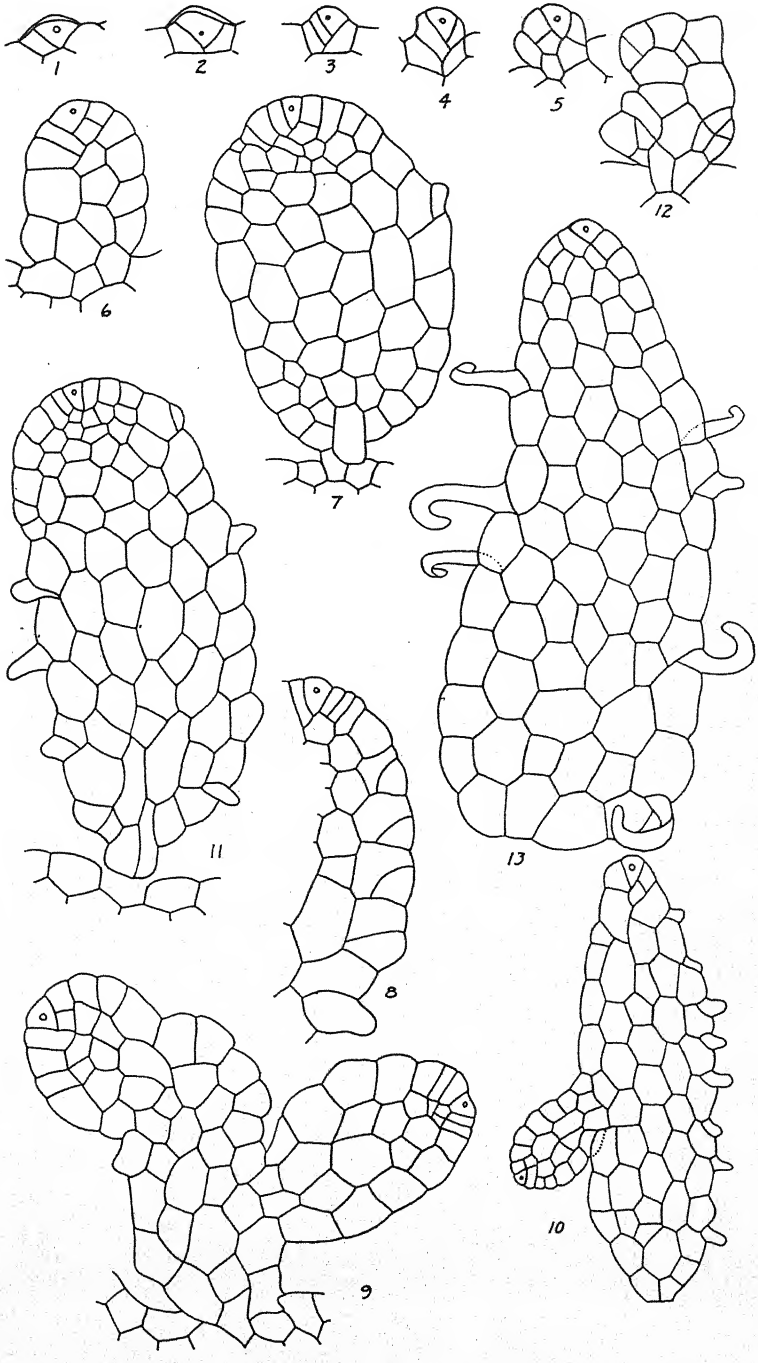
There is no evidence of acropetal succession in the production of gemmae, for larger gemmae may be interspersed among smaller ones. Sometimes they occur in definite groups. The gemmae are four to seven cells in width and are variable in shape, ranging from linear to ellipsoidal. Sometimes they are broad at the base where they are attached to the thallus (Fig. 6), and sometimes they are constricted

EXPLANATION OF FIGURES

FIGS. 1–12. METZGERIA MYRIOPODA. 1. Apical cell initial with first wall. 2. Dolabrate apical cell. 3. First segment cut off from apical cell. 4–6. Developmental stages of young gemmae. 7. Mature gemma still attached to thallus. 8. Development of hairs along margin of gemma, beginning with fifth segment from apical cell. 9. Formation of a secondary gemma while still attached to thallus. 10. Detached gemma showing a small secondary gemma and the characteristic short marginal hairs. 11. Separation of mature gemma from thallus. 12. Gemma having no definite apical cell.

FIG. 13. METZGERIA UNCIGERA. Gemma showing hooked marginal hairs.

All figures were drawn with the aid of a camera lucida at an approximate magnification of 650x and reduced to one third in reproduction.



GEMMAE IN METZGERIA

so as to appear stalked (Fig. 7). Their length varies greatly, and they are often large enough to be distinguished without the aid of a lens, being occasionally 1.5 mm. long before separating from the thallus. An occasional gemma was found which failed to develop normally and which had no apparent apical cell (Fig. 12).

A gemma arises from a single marginal cell of the thallus which becomes papillate. A gelatinous substance usually forms over the initial, much as in *M. furcata,* but soon after the gemma starts developing it disappears. A wall cuts across this initial at an angle from the outer margin to the base (Fig. 1). This division is followed by the formation of a second wall which also cuts across from the outer wall but in the opposite direction and intersects the first wall (Fig. 2), thus forming a dolabrate apical cell. From this apical cell segments are cut off to right and left forming a plate of undifferentiated cells (Figs. 3–7). Gemmae often separate from the thallus without any signs of differentiation, although occasionally the cells of the basal portion toward the center of the gemma become somewhat elongated and their contents denser, showing the tendency toward formation of a midrib. There seems to be no sharp line of demarcation between a gemma and the thallus which develops from it, the former gradually becoming longer, wider, and more differentiated as growth continues. Secondary gemmae frequently arise from a new apical cell which is cut off from one of the marginal cells of a gemma (Figs. 10, 11). These secondary gemmae develop in the same manner as the primary.

Marginal hairs may develop almost anywhere along the edge of a gemma, but usually arise near the apical cell. They originate from a single cell by the formation of a new cell wall which comes in at an angle curved away from the apical cell (Fig. 8). This segment becomes papillate and enlarges, but the hairs on the gemmae do not become as long as those on the thallus proper, as previously indicated by Evans. Lindberg (3) stated that "hairs are always affixed between the corners of the cells." By their development from a segment cut off at one corner of a cell they assume this appearance. Many of the hairs do not remain marginal but become somewhat displaced to one surface, showing a tendency toward dorsiventrality.

Separation of a gemma from the thallus which produced it occurs simply by the splitting of its walls from those of the thallus cells (Fig. 11) without any disintegration of tissues. A small notch in the thallus is all that remains to indicate where the gemma was attached.

At the time of separation the gemmae are variable in size, for separating individuals have been found even as small as the gemma shown in Fig. 6; the one in Fig. 11 is more typical, however.

FLORIDA STATE COLLEGE FOR WOMEN,
TALLAHASSEE, FLORIDA

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THE SULLIVANT MOSS SOCIETY'S 1939 FORAY

PAUL M. PATTERSON

THE Sullivant Moss Society joined the Botanical Society of America, the American Society of Plant Taxonomists, the American Fern Society and the Southern Appalachian Botanical Club on its annual foray, June 15–18. The Committee on Flora of the Virginia Academy of Science arranged for the meetings and planned the field trips.

Most of the group attending, a total of sixty-five persons, were comfortably housed at the Mountain Lake Biological Station of the University of Virginia, Giles County, Virginia, while a few stayed in Blacksburg, a few miles away.

Bryologists attending were Dr. H. L. Blomquist of Duke University, Lt.-Col. R. P. Carroll of the Virginia Military Institute, Dr. Margaret Fulford and Miss Margaret Manley of the University of Cincinnati, Dr. Elbert L. Little of the U. S. Forest Service, Tucson, Arizona, Dr. Aaron J. Sharp of the University of Tennessee, and the writer. Rev. Fred W. Gray and his sons, Frank and James, of Phillippi, West Virginia, were with the party the night of the 15th but left the next morning.

Field trips were planned for the 16th, 17th, and 18th, and evening programs for the 15th and 16th. The first evening, Dr. Ivey F. Lewis of the University of Virginia presided at the program held at the Mountain Lake Biological Station. It consisted of the following papers:

1. Mixed Deciduous Forests of the Appalachians. E. LUCY BRAUN, University of Cincinnati.

2. The Bryophytes of the Southern Appalachians. AARON J. SHARP, University of Tennessee.

3. Ferns of the Southern Appalachians. H. L. BLOMQUIST, Duke University.

4. Trees and Shrubs of the Southern Appalachians. H. R. TOTTEN, University of North Carolina.

The next morning the Sullivant Moss Society followed the trip planned for the whole group, who went over Big Mountain to the Big Stony Creek valley, on to Narrows, Virginia, for lunch, then back to Blacksburg via Eggleston for dinner. On Big Mountain, *Leptodon trichomitrion*, in addition to the usual epiphytic flora, was seen on the tree trunks. On rocky ledges, in addition to a profusion of more common forms, were *Herberta tenuis* and a tufted form of *Dicranum montanum*. The latter, noted by Dr. Sharp, reminds one in the field of *Brothera leana*. In a meadow along Big Stony Creek, Dr. Blomquist collected three *Sphagna* apparently unreported from the region.

The evening conference for the 16th was held at the Virginia Polytechnic Institute, where Prof. A. B. Massey, of the Institute, presided over the following program:

1. Some Old Collections of Southeastern Plants. M. L. FERNALD, Gray Herbarium, Harvard University.

2. Plant Migrations and Vegetational History of the Mid-Appalachian Region. EARL L. CORE, West Virginia University.

3. Continental Displacement and the Origin of the Southern Appalachian Floras. W. H. CAMP, New York Botanical Garden.

On Saturday morning, the 17th, the bryologists and members of the American Fern Society went on a trip of their own to Mountain Lake and down its drainage branch to the valley below. By afternoon, the Society's numbers were diminished by the departure of Drs. Sharp and Blomquist. The rest of the group went to the cascades of Little Stony Creek, where, in a profusion of hepatics and mosses, occur such forms as *Catharinea crispa, Porotrichum alleghaniense, Hookeria acutifolia, Gymnostomum calcareum, Mnium punctatum* var. *elatum* and many mosses common to the region; as well as *Trichocolea tomentella, Reboulia hemisphaerica* and other hepatics.

Those attending enjoyed an unusually profitable and pleasant foray. The group dispersed on the morning of the 18th.

HOLLINS COLLEGE, VA.

THE BRITISH BRYOLOGICAL SOCIETY

THE British Bryological Society held its Annual Meeting and Excursion at Llangollen, Denbighshire, N. Wales, from August 27 to September 3, 1938. Mr. J. B. Duncan, President and Treasurer, Miss E. Armitage, Vice-President, Mr. A. Thompson, Secretary, Mr. W. R. Sherrin, Librarian, and upwards of 25 members and friends were present, including a distinguished American bryologist, Dr. Winona H. Welch, of DePauw University, Indiana, who was concluding her visit of the principal European Herbaria in furtherance of her important work of monographing the Fontinalaceae. She was able to meet British bryologists and to see species of *Fontinalis* growing in the Welch streams amid the fine scenery of mountain, moorland, bog, and rocky waterfalls. The rocky bed of the Dee at Llangollen exposed by low river, enabled one to reach *Madotheca Porella* (Dicks.) Nees, and *Grimmia leucophaea* Grev. on dry rocks. On a long excursion by cars through Chirk to Llan-rhaiadr we had the benefit of the guidance of Dr. H. Hamshaw Thomas of Cambridge. Pistyll Rhaiadr is a high fall, the peat-brown water tumbling over a rugged rock-face, spanned by a natural arch. Here were seen *Mnium orthorrhynchum* B. & S., *Grimmia Hartmani* Schp., *Dicranum fuscescens* Turn., *Cynodontium Bruntoni* B. & S., *Eurhynchium myosuroides* var. *rivulare* Holt, *Lophozia Floerkii* (Web. & Mohr) Schiffn., *Aplozia cordifolia* (Hook.) Dum., *Eucalyx obovatus* (Nees) Breidl., and *Scapania dentata* forma *ambigua* DeNot. Another fall was visited beyond Llanarmon, in the rocky gorge of the Ceiriog; here were *Andreaea Rothii* Web. & Mohr and *A. petrophila* Ehrh., *Dicranella secunda* Lindb., *Trichostomum tenuirostre* var. *Holtii* Braithw., *Bryum alpinum* var. *viride* Husn., *Aneura pinguis* forma *angustior* Hook., *Cephaloziella Starkii* (Funck) Schiffn., *Lejeunea patens* Lindb. Walking up a long valley partly through woodland, near Llangollen, we came to the limestone rocks of the "World's End" where is the precipitous escarpment of the Eglwyseg Rocks. On the ledges grew *Orthothecium intricatum* B. & S., and *Neckera crispa* var. *falcata* Boul., also *Trichostomum mutabile* Bruch and *tortuosum* Dixon, *Fissidens decipiens* DeNot., *Metzgeria pubescens* (Schrank) Raddi, *Lophozia incisa* (Schrad.) Dum., *L. quinquedentata* (Huds.) Cogn., *Lepidozia Pearsoni* Spruce and *Nowellia curvifolia* (Dicks.) Mitt., *Scapania aspera* Bernet and *Cololejeunia calcarea* (Lib.) Schiffn. On a long excursion by cars we climbed up to the high pass of Bwlch-y-Groes, 1750 ft., along a rough narrow track.

The extensive boggy moorland held many *Sphagna* and other bryophytes, and commanded a grand view of the mountain chains of North Wales; a few plants seen were *Polytrichum strictum* Banks, *Aulacomnium palustre* Schwaegr., *Marsupella Pearsoni* Schiffn., *M. aquatica* (Lindenb.) Schiffn., *Leptoscyphus Taylori* (Hook.) Mitt., *L. anomalus* (Hook.) Mitt., and *Odontoschisma Sphagni* (Dicks.) Dum.

The Annual Meeting took place on August 30. Mr. J. B. Duncan has completed his term of office as President, and Miss E. Armitage became President on January 1, 1939. Mr. W. R. Sherrin was elected to the vacant post of Vice-President. Dr. L. B. C. Trotter, after several years of work as bibliographer, which was greatfully acknowledged, has resigned. Mr. C. V. B. Marquand is filling his place and the records will be kept in future at Kew Herbarium, where new publications should be sent. Mr. A. Thompson continues as Secretary.—ELEONORA ARMITAGE, Dadnor, Ross, Herefordshire, England.

DR. ALEXANDER ZAHLBRUCKNER

ALBERT W. C. T. HERRE

The recent death of Dr. Alexander Zahlbruckner, in his eightieth year, has taken away the world's most eminent lichenologist since Nylander, indeed one may safely say the foremost lichenologist since Acharius. His position was established with the publication of his systematic treatise on the classification of lichens in 1907, in "Die Natürlichen Pflanzenfamilien." Before this he had studied with the leading authorities in Austria, Germany, France, and Switzerland. His summers were spent in field work, from the time he was a university student until the world war.

It was my privilege to have this wise, kindly, and enthusiastic scientist as a teacher and personal friend. As already indicated, he was a great field botanist, and for many years spent his summer at Schladming, in the Styrian Alps. After comparing my California lichens with authentic material at the great Natural History Museum at Vienna, I followed Dr. Zahlbruckner to Schladming, and had the great pleasure of his daily companionship amid the dolomite vales and peaks on one side of the Enns, and the volcanic *thals* and spectacular *zinken* of igneous rock on the other side.

Dr. Zahlbruckner was very helpful to all who sought his advice or assistance. He was the first botanist to give me any real encouragement or aid in the study of lichens, in 1903, after the few American students had ignored my requests. While he was always ready to give serious-minded beginners the benefit of his knowledge, he had little patience with those who were mere dilettantes, and his criticisms of them were very drastic at times.

Dr. Zahlbruckner had a wide knowledge of the general domain of botany, and published some valuable work on flowering plants, particularly of Bolivia. He was also a man of broad interests, with a great knowledge of the folkways, archaeology, antiquities, and culture of the Austrian empire, particularly of Styria. He had an extraordinary command of languages, even in that land of polyglots, the old Austrian empire. He read easily all the languages of Europe, and spoke and wrote many; "nur Finnisch, aber Finnisch ist sehr schwer," he said in reply to a question. Like many others of his time and place, he grew up without a mother tongue, speaking German with his father, Hungarian with his mother, and "Nord Slavisch" or Moravian with the servants from infancy. Then, in school, Latin, Greek, and many modern languages followed; owing to lack of opportunity to acquire a correct accent he never mastered English pronunciation although his command of the printed word was excellent. He was very fond of discussing English literature with me.

At the time I studied with him, in 1907, and up to the time of the war, Dr. Zahlbruckner had the finest library of books on lichens in existence; that he was able to keep it up in later years is doubtful. The poverty, distress, and misery of Vienna and its people in recent years has been a major tragedy, and now is a catastrophe.

The student of lichens in every part of the world must know and use the works of Dr. Zahlbruckner. His "Catalogus Lichenum Universalis" is indispensable to really critical work on lichens, although of course it is not necessary to those who are not specialists. Nevertheless, it gives all students of lichens a solid foundation in the most difficult part of systematic work, synonymy.

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THE MOSS EXCHANGE CLUB

As announced in THE BRYOLOGIST 38: 100, Sept.-Oct., 1935, there is now an exchange club for mosses. This exchange is available to members of the Sullivant Moss Society upon payment of annual dues of 25 cents to Mrs. Inez M. Haring, Woodland, Ulster Co., N. Y. Only fully identified specimens in packets with complete data on them should be sent in. It is suggested that there be five or more packets of each species.

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CONTENTS

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GEORGE ELWOOD NICHOLS

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GEORGE ELWOOD NICHOLS, 1882–1939[1]

Doctor George Elwood Nichols, President of the Sullivant Moss Society, died June 20, 1939, in New Haven, Connecticut.

The son of the late Reverend and Mrs. George E. Nichols, he was born on April 12, 1882, in Southington, Connecticut. He was graduated from Hillhouse High School in the class of 1900, and in the same year entered Yale University, which conferred upon him the A.B. degree in 1904 and the Ph.D. degree in 1909. Doctor Nichols' connection with Yale University began with his graduate work, during which he held the title of Assistant in Botany. Upon his attainment of the doctorate, he was appointed Instructor in Botany, from which he passed successively through the teaching ranks of Assistant Professor, 1915–1924; and Associate Professor, 1924–1926. Since 1926, he served simultaneously in three important capacities, namely, as Eaton Professor of Botany, as Chairman of the Department, and as Director of the Marsh Botanical Gardens. In 1920, he joined the teaching staff of the University of Michigan Biological Station, where, every summer, he taught courses concerned with the Taxonomy of the Algae and of the Bryophyta. Doctor Nichols' course in Bryophytes at the University of Michigan Biological Station rapidly became known over the country and each summer found a new group of

[1] In addition to the basic facts obtained from "American Men of Science," much of the material contained here was furnished through the kindness of several individuals. I am particularly grateful to Professor G. R. LaRue, Director of the University of Michigan Biological Station, for the loan of much documentary material, especially a memorial prepared by him for reading at a service held July 13 at the Biological Station. A paper prepared by Professor H. J. Lutz of Yale University, for publication in "The American Journal of Science," has also been drawn upon freely. The photograph which appears here, furnished by Mrs. Grace Walker Nichols, is from the studios of Kaiden Kazanjian, New York City.

students inspired with a lasting interest in bryophytes. Many of those among the present group of younger professional and amateur American bryologists owe either their initial interest or part of their professional training to him. Doctor Nichols' vigorous personality, extremely high professional standards, and remarkable literary ability were quickly recognized among botanists, and he was soon called upon to occupy many offices of responsibility and importance. From 1925 to 1932 he served as Treasurer of the Botanical Society of America, and became Vice-President of the same Society in 1933. In 1920 he was elected Vice-President, and in 1932 President, of the Ecological Society of America. In 1938 he was elected President of the Sullivant Moss Society, which office he still held at the time of his death. At various times he was a member of the editorial board of one or more scientific journals.

Because of the large amount of bryological work which has been done at Yale University, and his association as a student with the eminent hepaticologist, Doctor Alexander William Evans, Doctor Nichols could not help becoming interested in bryophytes. While still a graduate student, he rose to prominence as a bryologist through his joint authorship with Doctor Evans of "The Bryophytes of Connecticut." This very important book, published in 1908 by the Connecticut State Geological and Natural History Survey, appeared at a time when few keys existed for the identification of the mosses and especially the hepatics of the northeastern United States. As it filled a long-felt want, this publication naturally became widely distributed and much used, and has retained its usefulness until the present time. Following the appearance of "The Bryophytes of Connecticut," Doctor Nichols made further systematic researches upon the mosses of the state, upon which he published four reports between 1910 and 1913, under the title "Notes on Connecticut mosses, I–IV." During the participation of the United States in the last World War, he served as botanical adviser to the American Red Cross on the *Sphagna* used for surgical dressings. The publications resulting from his investigations on this subject are still of the utmost interest and practical importance, since they discuss the species best adapted for surgical uses and their distribution in the eastern United States. Doctor Nichols' long experience with *Sphagnum* in the field gave him a thorough knowledge of the species and an amazing ability to recognize them at sight. Extensive field work in Nova Scotia,

especially on Cape Breton, was followed by the publication of two important papers on the bryology of the region: "The bryophytes of Nova Scotia, with special reference to Cape Breton," and "Additions to the list of bryophytes from Cape Breton." His association with the University of Michigan Biological Station, beginning in 1920, naturally resulted in a series of pioneer publications on the bryophytes of Michigan, which continued through the pages of THE BRYOLOGIST from 1922 to 1938. The masterly papers on the bryophytes of Nova Scotia and of Michigan, which effectively brought together and integrated his work with the work of others, established his position as one of the leading American bryologists.

Doctor Nichols most remarkable achievement was perhaps his attainment of leadership in two fields of botany. In addition to the outstanding work in bryology already discussed, his reputation was even more widely established by his work in plant ecology. Following his period of graduate study at Yale University, he studied during 1910 at the University of Chicago under the eminent scientist and teacher, Henry Chandler Cowles, from whom he received inspiration which strongly influenced his career. During this early period he accompanied the International Phytogeographic Excursion across North America (Torreya **14**: 55–64. 1914). In 1913, he began the publication of a series of papers dealing with the ecological aspects of the vegetation of Connecticut, a series which ran into seven parts, the last of which appeared in 1920 (Torreya 1913, 1914, Bull. Torrey Bot. Club 1915, 1916, 1920).

His study of the vegetation of northern Cape Breton, Nova Scotia, resulted in the publication of another important contribution (Trans. Conn. Acad. **22**: 249–467. 1918) in which he introduced a useful scheme of classification for writing ecological papers on the vegetation of regions. In connection with his field studies he was especially interested in the application of terms in ecological study (Plant World **20**: 305–316. 1917), in establishing a working basis for the ecological classification of plant communities (Ecology **4**: 11–23, 154–179), and in classification of vegetational units (Proc. Intern. Congr. Plant Sci. **1**: 629–641. 1929). His concepts and his classifications set forth in these papers have been useful to plant ecologists and will continue to be used by them. It has been said that he regarded classification as a tool in ecological work, "as a means to an end and not as an end in itself." Doctor Nichols has contributed about thirty

papers to the literature on the vegetation of northeastern America and ecological classification. In all his papers designed primarily for ecologists, he cited bryological data as well as those based exclusively on the higher plants, and was able, gradually, to educate many of his colleagues to an appreciation of the importance of the ecology of bryophytes.

Doctor Nichols will be remembered as much for his vigorous, energetic personality as for his scientific achievements. He was generous to a fault, and must have deprived himself at times, as the result of his impulsive gifts of valuable specimens and literature. Still more important than generosity in material things, however, he gave unsparingly of time, energy, and advice to help in the enterprises of his colleagues, friends, and students. Many of the younger generation of bryologists owe him everlasting gratitude for his critical and competent judgment of their problems and manuscripts, submitted to him for the benefit of his broad knowledge and remarkable critical faculty.

The Sullivant Moss Society has lost a dynamic leader, who, in spite of urgent executive duties and poor health, was deeply concerned with improving the affairs of the Society. The members of the Sullivant Moss Society, individually and collectively, feel deeply the loss of an extraordinary personality and a sincere friend.—WILLIAM CAMPBELL STEERE.

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PELTIGERA ON LONGS PEAK, COLORADO, AND IN IOWA COUNTY, IOWA*

WALTER KIENER

In his posthumous publication, "The Lichen Flora of the United States," the late Bruce Fink listed fourteen species of *Peltigera* with their range of distribution as known before 1935.

Additional information, chiefly on altitudinal and geographical distribution and extension of range, is recorded in the following notes on sixteen species. One of these is here listed for the first time for North America, namely, *P. lepidophora.*

The genus under consideration was extensively observed and collected as a part of ecological research on Longs Peak and vicinity, in and near Rocky Mountain National Park in northern Colorado, in the neighborhood of latitude 40° N., where the area is typical mountain land.

* Contribution 117 from the Department of Botany, University of Nebraska.

Further observations and collections were made on a north-facing slope banking the Iowa River near Amana, in Iowa County, Iowa. The elevation was about 750 feet above sea level and the latitude nearly 42° N. The dominant vegetation was an oak forest rich in mosses and lichens. The genus *Peltigera* was abundantly represented. On a small area, ten by ten meters, five species of this genus were collected. Listed in the order of relative abundance they were: *P. polydactyla, P. canina, P. praetextata, P. Evansiana,* and *P. erumpens.* Only the first two were fruiting, but all were in good vegetative condition. Apparently they were an integral part of the plant population of the forest floor.

The species are listed in this paper with their taxonomic status and authorship as they were very recently determined by Dr. V. Kofarago-Gyelnik of the State Museum of Hungary. He is to be considered at present the foremost worker on the genus *Peltigera,* of which he is preparing a monograph of European species. Dr. B. Lynge of the University of Oslo, Norway, and Mrs. Joyce Hedrick Jones of the University of Michigan also have confirmed or criticized some of the determinations of the species, notably those of *P. rufescens.* For suggestions and information the writer is further indebted to Dr. Alexander W. Evans of Yale University.

For references to those species not listed in Fink's "Flora" the reader must consult Zahlbruckner's "Catalogus." Several species, however, have since been published and the taxonomic status of others changed. There are also some disagreements with regard to authorship, further showing the need for a taxonomic revision of this genus. It is unfortunate for American progress in lichenology that the more recent species of this genus were mostly published in scattered foreign journals, available in the United States only to workers in a very few privileged institutions. For geobotanical reasons, a taxonomic revision of the American species of this genus is urgently needed.

PELTIGERA VARIOLOSA (Mass.) Gyel. var. LEUCOPHLEBIA (Nyl.) Gyel. Seventeen collections of this species have been made from the foothills of the montane zone to the alpine zone, ranging in elevation from 7,200 to 14,000 feet. Optimum conditions of climate for this species seem to prevail between 10,000 and 11,000 feet where the only fruiting plants were found. Nine collections came from the alpine zone and are of the complicate form, a modification induced by the alpine environment.

Regarding eco-sociological relationships, all collections came from "snowpatch" vegetation, that is, places where snowdrifts linger until spring and summer, in the alpine zone as well as in the forested zones. This is somewhat startling as none of the many writings on European "snowpatch" vegetation, with which the writer is acquainted, mentions a species of *Peltigera.* In the United States the "snowpatch" vegetation has not been studied. All specimens observed were intimately associated with bryophytes.

Specimens of the Longs Peak plants were identified by Lynge as *P. leucophlebia* (Nyl.) Gyel., the name which Lynge has accepted for this plant.

Up to recently this species has been included with *P. aphthosa* as a variety or form.

From the Arctic, *P. variolosa* var. *leucophlebia* (*P. leucophlebia*) is reported as common, but *P. aphthosa* (*sensu ang.*) as much less common.

From the Swiss Alps *P. aphthosa* (*sensu lat.*) is reported as well fruiting in the forest zones, and is also found in the alpine zone. As no segregation has been made it is not known certainly whether *P. variolosa* does occur on the high Alps, although its occurrence might be expected.

It is to be assumed that *P. aphthosa* of Fink's "Flora" includes *P. variolosa,* but no segregation has been reported for the United States. On Longs Peak and vicinity *P. aphthosa* (*sensu ang.*) has not been found.

PELTIGERA VENOSA (L.) Baumg. This species ranges widely and often abundantly from the foothills to timberline. The highest occurrence was observed on Longs Peak at 11,100 ft., but it probably reaches higher. Optimum conditions for the species seem to prevail between 9,500 to 10,500 ft. altitude on humid forest sites where it often forms mass vegetation. It grows on bare soil and is practically always fruiting. Its associated plants are bryophytes.

From the Arctic the species is reported as occurring widely but sparsely and often sterile. It is known from the high Alps.

PELTIGERA HORIZONTALIS (L.) Hoffm. When sterile this species is difficult to separate from plants of *P. polydactyla* and all early determinations are open to doubt. But during the summer of 1938 a great many fruiting plants were found that made the presence of this species certain. It occurs widely and abundantly in bryophytic

communities in the spruce-fir forest of the subalpine zone. There is much reason to believe that this species occurs also high in the alpine zone where, on Longs Peak, many plants were collected that suggest this species, or possibly the one next listed. Inasmuch as all of these plants were dwarfed and otherwise modified, the correct determination must be deferred to a comparative study of more material.

The species is not reported from the Arctic or the high Alps.

PELTIGERA POLYDACTYLA (Neck.) Hoffm. Fruiting specimens of this species have not been found on Longs Peak or its vicinity. Some sterile specimens as mentioned above under *P. horizontalis* may need to be referred to *P. polydactyla*. The Arctic distribution of this species suggests its occurrence on Longs Peak and other Colorado mountains.

In Iowa this species was very abundant in the oak forest. It was well fruiting and grew over mosses and between mosses, so that it must be considered a member of the community of bryophytes.

Well fruiting, and of similar habit and similar growing conditions, but in an aspen forest, plants of this species were found in Teton county of Wyoming at 7,200 ft. altitude.

From the Arctic this species is reported as occurring but sparsely. From the high Alps it is not listed.

PELTIGERA SCUTATA (Dicks.) Leight. f. COLLINA (Ach.) Gyel. This species was found twice in the foothills area on northerly slopes in canyons. Both sites were densely forested and generally rich in cryptogamic plants. The elevations were 7,200 and 8,200 feet respectively. It must be a relatively rare plant.

It is not reported from the Arctic or the high Alps.

PELTIGERA MALACEA (Ach.) E. Fr. Of six collections of this species four were made in the alpine zone on Longs Peak. The lowest occurrence was at about 10,400 feet and the highest at 13,700 feet. It always grew with bryophytes and was sterile. All plants were small and of the complicate type of modification.

The species is reported as rare to not uncommon from the Arctic. It is not reported from the high Alps.

PELTIGERA RUFESCENS (Sm.) Hoffm. All five collections of this species were made in the alpine zone on Longs Peak, ranging in elevations from 12,000 to 13,000 feet. It was always growing over mosses as a member of a community of bryophytes. All plants were small and sterile. For this vicinity this is so far the only species restricted to the alpine zone.

It is reported as a very common lichen from the Arctic where it is often found fruiting. It is also common on the high Alps.

Unintentionally, none of these plants were submitted to Gyelnik.

PELTIGERA CANINA (L.) Willd. On account of its variability this species is a troublemaker and herbarium specimens show that almost anything that is not easily determined is given this name. It occurs widely and usually abundantly from the foothills to timberline, even entering the alpine zone. It was collected from 7,200 to 12,000 feet. Rarely it was found on bare soil, but usually over mosses and, interestingly, over layers of pine needles. Like mosses, a layer of pine needles will retain water longer than bare soil. This water relation is perhaps a chief reason that the species of *Peltigera* are so intimately associated with bryophytes.

P. canina f. *subnitens* Harm. is a form that seems morphologically more constant than the type and considerably different from it; is ecologically also different from the type in being restricted to bryophyte communities, bare soil, and rocks on wet streambanks and on borders of springs. The several collections were made at around 10,000 feet altitude. Further studies are needed, but it seems probable that the narrow ecological range and the constant morphological characters, will entitle this plant to specific rank. The plants were fruiting.

P. canina forma nova **rimosa** Gyel. is diagnosed by Gyelnik as follows: "Thallus non panniformis, non digitatus, superne pro parte rimoso-areolatus, epruinosus. In ceteris sicut var. *rufescens* (Weis.) Willd." This form was found only once on a well drained slope in the subalpine forest at 10,350 feet altitude. The plants were sterile.

In the oak forest in Iowa the more or less typical species was found abundantly and well fruiting. All specimens were of a purplish-brown color and rather dark. It is often said that exposure to sun causes a lichen to become dark, but these plants were all in shade on a north-facing slope. In contrast, all specimens from Colorado were of light color, brownish- or greenish-gray, and morphologically somewhat different.

The species is reported from the Arctic as well as from the high Alps.

PELTIGERA VIRESCENS (Stein.) Gyel. f. AREOLATA Gyel. This plant was collected but once in an aspen-lodgepole forest on a well drained site. The elevation was 9,050 feet. The plant was fertile and grew with bryophytes. No printed records of this and the next species were available.

PELTIGERA PLITTII Gyel. The forma *sandwichensis* Gyel. of this species were collected four times in Longs Peak valley at elevations of from 9,000 to 10,000 feet. The plants grew over pine needles and mosses and were fruiting.

The forma *ornata* Gyel. was collected once in the alpine zone growing over stubbles of *Elyna Bellardi*, a rather dry habitat. The plant was sterile.

PELTIGERA SPURIA (Ach.) DC. This species was collected twice, growing on soil and with mosses. One station was in the lodgepole forest in Longs Peak valley at 9,050 feet in a habitat which in summer is dry. The other station was at 9,600 feet in the forest burn on the slope of Twin Sisters Mountain. On the soil that was rendered sterile by the fire in 1929, moss protonemata appeared abundantly by 1931, and by 1934 when plants of *Bryum argenteum*, *Bryum caespiticium*, and *Ceratodon purpureus* had become abundant and fruiting, the first small *Peltigera* plants were observed. By 1938 *P. spuria* had become very abundant and was well fruiting. Also abundant was *P. crumpens* and there were a few plants of *P. canina*. It is interesting to note that the lichens were preceded by the mosses but followed closely the migration into the new area. This lends evidence to the belief that most plants of *Peltigera* are more or less dependent on the help of bryophytes for best development, such help being physical and consisting of greater capacity to retain water for the use of the plants.

This species is reported from the high Alps but not from the Arctic.

PELTIGERA PRAETEXTATA (Flk.) Zopf var. SUBCANINA Gyel.

PELTIGERA EVANSIANA Gyel. Both species were found associated with bryophytes in the oak forest in Iowa. Both were fairly abundant but sterile. Both are additions to the flora of Iowa.

They are not reported from Colorado, the Arctic, or the high Alps.

PELTIGERA LEPIDOPHORA (Nyl.) Bitt. This little plant was collected five times, quite unknowingly. It was discovered in the laboratory among mosses and lichens. The stations for it range in altitude from 8,700 to 12,500 feet. In each instance only one to three plants were found in a single collection. Several thousand collections of lichens and bryophytes from Longs Peak and vicinity have passed examination, and the species being found only five times, it must be considered as being rare. This is the first record of its occurrence on this continent.

From the Arctic it is reported as widespread but rare and scarce. From the high Alps it is unreported.

PELTIGERA ERUMPENS (Tayl.) Lang. Ten collections were made of this species ranging from 9,000 to 13,300 feet on Longs Peak. Half of the collections were made in the alpine zone. The plants were small and grew on soil between bryophytes. According to Gyelnik the Colorado plants belong to the forma *glabrescens* Gyel.

Specimens of the typical species were collected in Iowa, in the oak forest and on an open road cut. The plants were abundant and occasionally grew without the company of mosses.

In part, *P. erumpens* is *P. sorediata* of Fink's "Flora."

The species is reported from the Arctic but not the high Alps.

PELTIGERA LEPTODERMA Nyl. Only one collection of this species was made in Colorado. This was on the south slope of Longs Peak in the spruce-fir forest at an altitude of 10,350 feet where the plant grew associated with bryophytes.

Other plants were collected in Teton county of Wyoming where they grew associated with bryophytes in an aspen forest at an elevation of 7,200 feet. All plants were infested with species of epiphytic lichens and fungi. Apparently this is a rare species and also is in part *P. sorediata* of Fink's "Flora."

The species is reported from the Arctic but not the high Alps.

SUMMARY

Geobotanical notes on *Peltigera* are recorded for thirteen species occurring on Longs Peak and vicinity in Colorado. New to North American botany is *Peltigera lepidophora*. Of the thirteen species nine also occur in the Arctic and four on the high Alps. Very nearly the same species which occur in the Arctic are also found in the alpine zone on Longs Peak up to record elevations. Two species are additions to the flora of Iowa.

Sociologically the genus shows an intimate relationship with communities of bryophytes. Scarcity of available information recommends the genus to the attention of the bryologist as well as the lichenologist.

It is concluded that *Peltigera* is a genus of boreal origin, and evidence for the affinity of the alpine vegetation of Colorado to boreal and Arctic vegetation.

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THE CHAMBERS OF MANNIA CALIFORNICA

DOROTHY F. PRESTON

In June, 1938, Doctors T. C. Frye and Lois Clark handed me some material of *Mannia* collected February 2 and March 1, 1938, near Trona, California, by Mr. John Broadbent. The material did not agree very well with any of the described species, and they wished, therefore, to have it critically examined.

It soon became apparent that this material falls nearest to *Mannia californica* or *Mannia fragrans*, differing from the former in that it has photosynthetic filaments instead of supplementary partitions. From the latter it differs (a) in horizontal floors of the chambers figured by Massalongo (Atti Reale Istit. Veneto **75**: 669–817, 1916) but not substantiated by Evans (Bull. Torrey Bot. Club **45**: 235–251, 1918); (b) in the single layer of air chambers; (c) in the presence of filaments in this single layer of chambers; (d) in the purplish color of the scales and the lack of an apical cluster of these. Our material is sterile. From Evans' excellent detail, it was evident that our material could not be referred to *Mannia fragrans*.

It was thus evident that so far as North American species were concerned there was either some error in the description of *Mannia californica* or the material would have to be referred to a new species.

Through the kindness of the New York Botanical Gardens there was available for examination material of *Grimaldia californica* collected in California by Bolander and formerly in the herbarium of Underwood, also a specimen of the same from California collected by A. J. McClatchie on the trail to Wilson's Rock at 4,000 feet and formerly in the herbarium of M. A. Howe. In neither of the collections were we able to identify any supplementary plates. The chambers were in

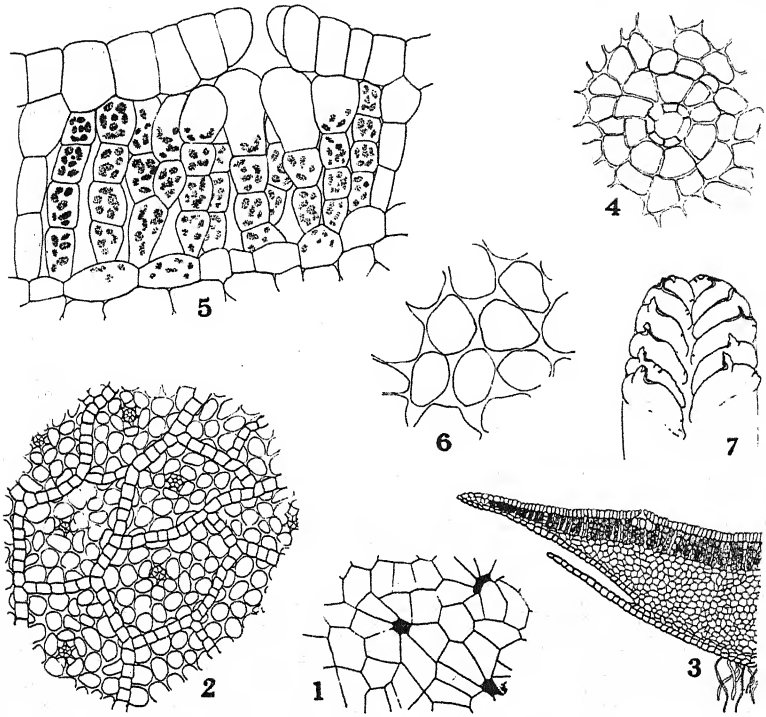
one layer with level floors from which arose filaments similar to those which we found in the Trona material.

Howe describes the air chambers as "almost wholly filled by secondary walls, leaving very small lacunae." If one interprets his secondary walls as filaments our plant agrees with his entirely. The filaments in the Trona material often reach the epidermis and are sometimes flattened by pressure against it. They are not attached to it, but might be mistaken for walls.

Examination of the material from Trona revealed that no vertical supplementary partitions or walls are present, but, instead, the dorsal chambers are densely filled with photosynthetic filaments. Partitions are present, but they are neither crowded nor supplementary. The partitions are attached to the epidermis and to the floor of the air chambers, and are composed of cells which are hyaline or nearly so. By cutting the epidermis from the thallus in such a way as to leave a portion of these partitions attached, it can be seen that each chamber has a pore, and that these partitions cannot be considered supplementary. It can also be seen that no walls or partitions composed of photosynthetic cells are attached to the epidermis. The absence of supplementary partitions and the presence of photosynthetic filaments were determined by examining cross sections, longitudinal sections, surface-cuts deep enough to cut the photosynthetic tissue in the chambers, and, finally, the green filaments obtained unattached to other cells by first removing the epidermis and then cutting the filaments along the floor of the chambers. By all of these methods, the green cells proved clearly to be in the form of filaments, but in no case were there found plates, walls or partitions composed of photosynthetic cells.

The air chambers of this Trona material are in a single layer and their floors are horizontal. The vertical partitions of hyaline cells are 3–5 cells high, and, in cross section, one cell thick except occasionally where attached to the epidermis or floor of the chamber. The filaments from the floors of the chambers are unbranched or dichotomously branched, usually 3–4 cells high, and green except the almost hyaline terminal cells in the regions of the pores. These terminal cells of the filaments are often larger than the lower ones; they vary in shape from globular to slightly elongate, and often have flattened tips. This flattening of the tip seems to occur where the photosynthetic filaments press against, but do not attach to, the roofs of the

chambers. Filaments such as these in the Trona material were seen in the material collected by Bolander, which also lacked supplementary plates, walls or partitions.



FIGS. 1–7. MANNIA CALIFORNICA. 1. Portion of a ventral scale (× 126). 2. Dorsal epidermis, ventral view, showing partitions between chambers and one pore only per chamber (× 67). 3. Portion of a cross section of thallus (× 37). 4. Pore of the thallus (× 210). 5. Vertical section of dorsal chamber (× 217). 6. Portion of the dorsal epidermis of the thallus (× 283). 7. Ventral view of portion of thallus showing scales and their appendages (× 6).

From the examination of the material from the New York Botanical Garden which has presumably been determined by Underwood and Howe, respectively, and from the comparison of these collections with the Trona material, it seems evident that Howe has described filaments seen in a cross sections of the thallus as plates. The Trona material is, therefore, referred to *Mannia californica* Wheeler (*Grimaldia californica* Gottsche). The description of the chambers of *M. californica* should, therefore, read as follows:

Chambers one layer deep, without supplementary partitions, crowded with photosynthetic filaments 3–5 cells long; the cells of the filaments shortly cylindrical or barrel-shaped; the terminal cells inclined to be somewhat larger, with rounded or flattened tip, those under the pore with little or no chlorophyll.

According to Evans, *M. fragrans* has no filaments. What are described as filaments are either supplementary walls or their projecting cells. Further there is no level floor to the uppermost chambers, differing very greatly from the account of Massalongo.

The genus description of the air chambers should, therefore, read as follows:

Dorsal chambers from not at all to closely subdivided by supplementary vertical or more or less horizontal partitions which sometimes have short teeth; the chambers when in one series crowded with vertical photosynthetic filaments.

Of the North American species of *Mannia, M. californica* therefore stands out as the only one which has one series of chambers with vertical filaments.

There is needed a monograph covering comparative morphology of the Mannias of North America.

DEPARTMENT OF BOTANY, UNIVERSITY OF WASHINGTON

MOSSES OF BARRO COLORADO ISLAND, CANAL ZONE

BARBARA WILLIS

The mosses listed below were collected by the author during January and February of 1938. Specimens of all species collected are in the herbarium of The Institute for Research in Tropical America at Barro Colorado Island, in the Canal Zone. In addition, the types of new species are in the herbarium of their author.

The writer wishes to express her great indebtedness to Mr. Edwin B. Bartram who so kindly classified this moss collection. He not only named and described the new species and noted the range extensions, but in addition he prepared the plate of illustrations.

FISSIDENTACEAE

FISSIDENS MOLLIS Mitt.

FISSIDENS KEGELIANUS C. M.

FISSIDENS (§SEMILIMBIDIUM) **Willisiae** Bartr. sp. nov. Figures 1a–1d.

Caules longiusculi, circa 7 mm. alti, rubri. Folia plurijuga, sicca arcte falcato-contorta, ad 1 mm. longa et 0.25 mm. lata, oblonga, breviter acuminata, lamina vaginans valde limbata, lamina apicalis elimbata, margines crenulati, lamina dorsalis ad basin costae late rotundata, elimbata, marginibus crenulatis; costa pallida, percurrens; cellulae minutissime, peropacae, papillosae. Fructus terminalis; seta 3–3.5 mm. alta, plus minus arcuata; theca suberecta, minuta.

Closely gregarious plants, bright green. Stems rather long, up to 7 mm., reddish-brown, densely foliate, about 2 mm. wide with leaves. Leaves in 15–20 pairs, minute below, the upper strongly contorted and falcate when dry, oblong, short acuminate, to 1 mm. long and 0.25 mm. wide, duplicate blades strongly bordered even to the lowermost leaves, apical blade not bordered, margins crenulate, dorsal blade ending in a rounded lobe at the insertion, not bordered; costa pale, percurrent; lamina cells minute, very opaque, papillose. Seta terminal, geniculate at base, slightly arcuate above, 3–3.5 mm. high; capsule minute, suberect.

More robust than *F. Ravenelii* Sull. with relatively broader leaves, red stems and the dorsal blade ending in a rounded lobe at the base.

FISSIDENS GARBERI Lesq. & James.

FISSIDENS (§PYCNOTHALLIA) **plurisetus** Bartr. sp. nov. Figures 2a–2d.

Dioicus? Sat robustus, caulis ad 8 cm. altus. Folia plurijuga, sicca leniter contorta, oblongo-lanceolata, breviter acuta, superiora ad 2 mm. longa, ubique limbata, limbo cartilagineo, bistratoso, pellucido; cellulae omnes subequales, perobscurae, papillosae, minutissime, 4–5 μ. Setae aggregatae ad 4, 3 mm. longae, superne arcuatae; theca suberecta, deoperculata 0.5 mm. longa; peristomii dentes rubri, inferne lati, intus alte cristati.

Dioicous? Rather robust plants, laxly gregarious, sordid green. Stems to 8 mm. high, 3 mm. wide with leaves, densely foliate. Leaves in about 15 pairs, the lower minute, the upper to 2 mm. long, oblong-lanceolata, short acute, bordered all around, the border cartilaginous, pellucid, two cells thick and minutely scabrous on the edges by projecting cell ends, 5–6 cells wide on the duplicate blades and about 3 cells wide above, sharply defined from the opaque lamina cells, dorsal blade ending in a rounded lobe at the insertion; costa pellucid, percurrent; cells uniform, very minute, 4–5 μ, dense and obscure, papillose. Setae aggregated, up to 4 from one perichaetium, 3 mm. long, arcuate above; capsules suberect, urn 0.5 mm. long; peristome teeth highly cristate on the inner face below the forks.

This unique species is sharply distinct from any of its North American congeners by the strong cartilaginous leaf border and the short, aggregated setae. It might bear comparison in a broad way

with *F. rigidulus* H. f. & W. but in that species the setae are solitary and much longer, and the leaf cells larger and clearly defined.

FISSIDENS RADICANS Mont.

FISSIDENS ASPLENIOIDES Hedw.

LEUCOBRYACEAE

LEUCOBRYUM MARTIANUM (Hornsch.) Hpe.

*OCTOBLEPHARUM ALBIDUM Hedw.

CALYMPERACEAE

SYRRHOPODON PARASITICUS (Sw.) Besch.

*SYRRHOPODON INCOMPLETUS Schwaegr.

CALYMPERES EMERSUM C. M.

An interesting range extension of this species, which has been previously known only from Florida, Honduras and the type station in Guatemala.

CALYMPERES NICARAGUENSE Ren. & Card.

CALYMPERES LEVYANUM Besch.

Although the stems in this collection are all short, not over 2–3 mm. high, the leaf structure agrees exactly with the description of *C. Levyanum*. Under the microscope the small, dense, obscure lamina cells are in bold contrast to the pellucid transversely elongate areolation of *C. lonchophyllum*. No specimens of *C. Levyanum* are available for comparison but it seems reasonably certain that the Panama plants may be referred here. The species is apparently quite rare and known only from Cuba and the type locality in Nicaragua.

BRYACEAE

*BRYUM CORONATUM Schwaegr.

BRYUM sp.—sterile.

BARTRAMIACEAE

*PHILONOTIS TENELLA (C. M.) Besch.

ORTHOTRICHACEAE

MACROMITRIUM MUCRONIFOLIUM (Hook. & Grev.) Schwaegr.

MACROMITRIUM FRAGILE Mitt.

* Species marked with an asterisk have been listed heretofore in *The Flora of Barro Colorado Island* by Paul C. Standley, published by The Arnold Arboretum of Harvard University, Jamaica Plain, Massachusetts.

LEUCODONTACEAE

LEUCODONTOPSIS FLORIDANA (Aust.) E. G. Britt.
PSEUDOCRYPHAEA FLAGELLIFERA (Brid.) E. G. Britt.

PTEROBRYACEAE

ORTHOSTICHOPSIS TETRAGONA (Hedw.) Broth.
PIREELLA CYMBIFOLIA (Sull.) Card.

METEORIACEAE

METEORIOPSIS RECURVIFOLIA (Hornsch.) Broth. (with hepatics).
METEORIOPSIS PATULA (Hedw.) Broth.

NECKERACEAE

*NECKEROPSIS UNDULATA (P. Beauv.) Broth.
*NECKEROPSIS DISTICHA (Hedw.) Fleisch.
POROTRICHUM COBANENSE C. M.

PILOTRICHACEAE

PILOTRICHUM AMAZONUM Mitt.
PILOTRICHUM BIPINNATUM (Schwaegr.) Brid.

HOOKERIACEAE

CYCLODICTYON ALBICANS (Hedw.) Broth.
CALLICOSTELLA PALLIDA (Hornsch.) Jaeg.
CALLICOSTELLA **aquatica** Bartr. sp. nov. Figures 4a–4d.

Dioica. Caules elongati, irregulariter ramosi, percomplanati, folia oblonga, ad 1.5 mm. longa, oblonga, obtusissima, apicibus rotundatis; costis binis, prope apicem evanidis, dorso fere laevibus; marginibus serrulatis; cellulae superiores ovali-hexagonae, subpellucidae, valde unipapillosae. Seta ubique scaberrima, 1 cm. longa.

Dioicous. Stems immersed, elongate, irregularly branched, very complanate. Leaves rather crowded, oblong, to 1.5 mm. long and slightly more than 0.5 mm. wide, broadly rounded at the apex and often obtusely apiculate; costae ending in a blunt spine near the apex, almost smooth on the back; margins minutely serrulate; upper lamina cells oval-hexagonal, rather pellucid, clearly unipapillate, more lax elongate and smooth below. Seta scabrous throughout, 1 cm. long; capsule horizontal.

This species is similar to *C. irrorata* (C. M.) Broth. but differs appreciably in the more crowded leaves and the unipapillate upper lamina cells.

CALLICOSTELLA **grossiretis** Bartr. sp. nov. Figures 3a–3d.

Autoica, gracillima, caespitosa, caespitibus pallide viridibus, opacis. Caulis repens, 15–2 cm. longus, irregulariter ramosus, cum foliis 1.5 mm. latus. Folia sicca leniter contorta, humida erecto-patentia, oblongo-lanceolata, breviter acuminata, haud limbata, circa 0.8 mm. longa, concava; marginibus superne arcte serrulatis; costis binis, ad basin acuminis evanidis, dorso magis serrulatis; cellulae omnes majusculae, perpellucidae, laevissimae, superiores rotundato-hexagonae 15–18 μ latae, marginales multo minores. Seta 4–5 mm. alta, flexuosa, ubique scaberrima; theca erecta, oblongo-cylindrica, deoperculata 0.8 mm. longa; peristomii dentes fusci, linea media valde exarati.

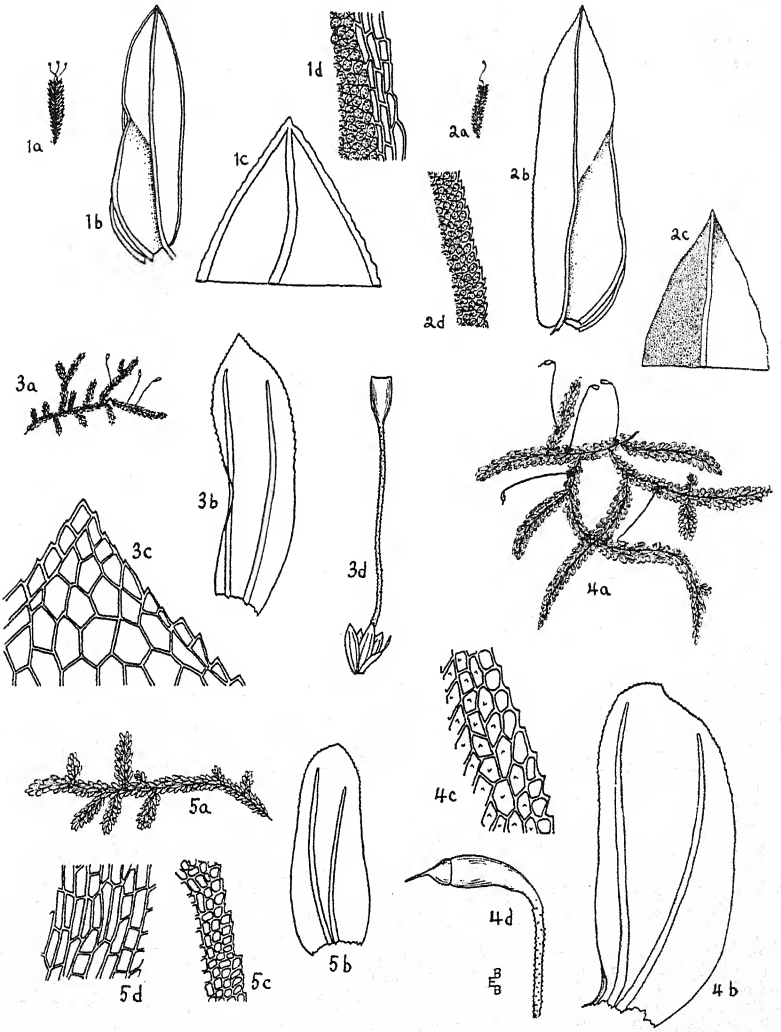
Autoicous. Slender, pale green plants without lustre in rather dense mats or tufts. Stems creeping, to 2 cm. long, irregularly branched, to 1.5 mm. wide with leaves. Leaves slightly contorted when dry, erect-spreading when moist, about 0.8 mm. long, oblong-lanceolate, concave, short acuminate, not bordered; margins sharply serrulate in the upper half; costae ending at the base of the acumen, strongly toothed on the back; cells large, lax, very pellucid, smooth, rounded-hexagonal above, 15–18 μ wide, with thin delicate walls, much smaller at the margins and more elongate below. Seta 4–5 mm. long, flexuose, scabrous to the base; capsule erect, oblong-cylindric, urn 0.8 mm. long; peristome teeth brownish, densely striolate, with a distinct median furrow on the outer face.

The generic position of this species is not obvious. The erect capsules, scabrous setae, unbordered leaves and serrated costae preclude *Cyclodictyon* and the large rounded upper leaf cells suggest no close affinite with *Hookeriopsis*. It is widely different from any familiar species of *Callicostella* but may be tentatively included here.

HOOKERIOPSIS **panamensis** Bartr. sp. nov. Figures 5a–5d.

Dioica? Sat robusta, caespitosa, caespitibus lutescenti-viridibus, opacis. Caulis elongatus, subpinnatim ramosus, ramis patulis, ad 7 mm. longis, complanatulis, cum foliis ad 2.5 mm. latis, obtusis. Folia conferta, sicca parum deflexa, e basi late cordata oblonga, rotundato-obtusa, 1.5 mm. longa, 0.5 mm. lata, haud vel lenissime undulata; margines superne irregulariter serrulati; costis binis, longe infra apicem evanidis, superne dorso serratis; cellulae superiores subhexagonae, ad 10 μ longae, inferiores sensim elongatae, omnes laevissimae. Fructus ignotus.

Dioicous? Rather robust plants in extensive tufts or mats, dull yellowish green. Stems 4 cm. or more long, creeping, subpinnately branched, branches spreading, obtuse, complanate-foliate, about 7 mm. long and 2.5 mm. wide with leaves. Leaves crowded, slightly deflexed when dry, oblong from a broadly cordate base, obtusely



FISSIDENS PLURISETUS Bartr. Fig. 1a, Plant, × 1. Fig. 1b, Leaf, × 17. Fig. 1c, Apex of leaf, × 80. Fig. 1d, Leaf cells and margin of apical blade, × 250.

FISSIDENS WILLISIAE Bartr. Fig. 2a, Plant, × 1. Fig. 2b, Leaf, × 42. Fig. 2c, Apex of leaf, × 80. Fig. 2d, Leaf cells and margin of apical blade, × 250.

CALLICOSTELLA GROSSIRETIS Bartr. Fig. 3a, Plant, × 1. Fig. 3b, Leaf, × 42. Fig. 3c, Apex of leaf, × 250. Fig. 3d, Sporophyte, × 6.

CALLICOSTELLA AQUATICA Bartr. Fig. 4a, Plant, × 1. Fig. 4b, Leaf, × 30. Fig. 4c, Upper leaf cells and margin, × 250. Fig. 4d, Capsule, × 6.

HOOKERIOPSIS PANAMENSIS Bartr. Fig. 5a, Plant, × 1. Fig. 5b, Leaf, × 18. Fig. 5c, Upper leaf cells and margin, × 250. Fig. 5d, Lower median leaf cells, × 250.

rounded at the apex, 1.5 mm. long, 0.5 mm. wide, not or only very slightly undulate; margins irregularly serrulate in the upper half; costae ending well below the apex, serrate on the back above; upper lamina cells small, subhexagonal, thin walled, to 10 μ long, median and basal cells gradually more elongate, smooth throughout. Fruit unknown.

Quite similar in gross appearance to *H. callicostelloides* Herz. & Thér. but readily distinguished by the obtusely rounded or broadly pointed leaves with the upper margins less strongly serrulate and the cells smooth.

CROSSOMITRIUM PATRISIAE (Brid.) C. M.

*LEPIDOPILUM POLYTRICHOIDES (Hedw.) Brid.

THUIDIACEAE

THUIDIUM INVOLVENS (Hedw.) Mitt.

*THUIDIUM SCHISTOCALYX (C. M.) Mitt.

PLAGIOTHECIACEAE

PILOSIUM LONGISETULUM C. M.

SEMATOPHYLLACEAE

POTAMIUM LONCHOPHYLLUM (Mont.) Mitt.

No specimen of this species can be located for comparative study but the aquatic habit, bluntly pointed ecostate chlorophyllose leaves with linear-vermicular cells and the small pendulous capsules seem to verify the determination without much doubt. The peristome teeth show a distinct median furrow on the outer face below the middle and the segments of the endostome are keeled from a high basal membrane and not perforate along the median line. Apparently *P. lonchophyllum* is known only from the type locality near Cayenne, French Guiana, so that present collection represents not only an interesting extension in geographical range but also a new genus to the North American moss flora.

TRICHOSTELEUM FLUVIATILE (Mitt.) Jaeg.

*TAXITHELIUM PLANUM (Brid.) Mitt.

HYPNACEAE

VESICULARIA AMPHIBOLA (Spr.) Broth.

ISOPTERYGIUM TENERUM (Sw.) Mitt.

ISOPTERYGIUM CHRISMARI C. M.

MITTENOTHAMNIUM DIMINUTIVUM (Hpe.) E. G. Britt.

BENNINGTON COLLEGE, BENNINGTON, VERMONT

Volume 42, Number 5, including pages 113–136, was issued October 6, 1939.

INDEX TO VOLUME 42

New scientific names are printed in bold-face type

Illustrations are indicated by an asterisk (*)

THE BRYOLOGIST

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ERRATA

Page 20, last line: for HORNSCH read HORNSCH.
Page 31, line 34: for TELERANEA read TELARANEA
Page 42, line 12: *for* Ågnstr. *read* Ångstr.
Page 120, line 20: for PTYCHOCOLEUS HETEROPHYLLUS Evans read LOPHOCOLEA HETEROPHYLLA (Schrad.) Dumort.

TABLE OF CONTENTS

VOLUME 42

NUMBER 5, PAGES 113–156, ISSUED OCTOBER 6, 1939

NUMBER 6, PAGES 137–168, ISSUED DECEMBER 8, 1939

THE HEPATIC EXCHANGE CLUB

Beginning January 1, 1939, this Club has been operated under the same rules as The Moss Exchange Club. Privileges are available only to members of the Sullivant Moss Society who have paid annual dues of 25 cents to Dr. A. J. Sharp, Department of Botany, University of Tennessee, Knoxville, Tennessee. Only fully determined specimens in packets with complete data will be accepted. It is suggested that there be at least five packets of each species with an extra which will be forwarded to the Curator of Hepatics for the Sullivant Moss Society Hepatic Herbarium. All material for determination should be sent to the Curator of Hepatics, Dr. Margaret Fulford, Department of Botany, University of Cincinnati, Cincinnati, Ohio.

THE MOSS EXCHANGE CLUB

As announced in The Bryologist 38: 100, Sept.-Oct., 1935, there is now an exchange club for mosses. This exchange is available to members of the Sullivant Moss Society upon payment of annual dues of 25 cents to Mrs. Inez M. Haring, Woodland, Ulster Co., N. Y. Only fully identified specimens in packets with complete data on them should be sent in. It is suggested that there be five or more packets of each species.

These two exchanges offer an excellent opportunity for S.M.S. members to build up their own herbaria of choice, well-labelled specimens.